

Phase 1 Preliminary Site Investigation Proposed Rezoning

Location:

Lot 16 DP 856265
225 Terranora Road
Banora Point NSW 2486

Prepared for:

Planit Consulting

Report No:

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Suite 29, Level 2, Wharf Central, 75 Wharf Street
PO Box 311, Tweed Heads NSW 2485
p. 07 5536 8863 f. 07 5536 7162
e. admin@hmcenvironment.com.au
w. www.hmcenvironment.com.au
abn 60 108 085 614

RE: Lot 16 DP 856265, 225 Terranora Road, Banora Point, 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



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

Document Control Summary			
HMC Environmental Consulting		PH:	755368863
PO Box 311		FAX:	755367162
Tweed Heads NSW 2485		Email	admin@hmcenvironment.com.au
Title:		Preliminary Site Investigation	
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EXECUTIVE SUMMARY

Background

A planning proposal including part rezoning to residential land is proposed for Lot 16 DP 856265, 225 Terranora Road, Banora Point, NSW, 2486. As the land has been used as a former quarry and subject to major excavation and filling, an assessment to meet the requirements of State Environmental Planning Policy No 55 *Remediation of Land* was undertaken.

HMC Environmental Consulting (HMC) was commissioned by Planit Consulting to undertake the required investigation and assess the proposed rezoning area for potential site contamination. A Phase 1 Preliminary Site Investigation (PSI) including a desktop assessment of available information, and a detailed site inspection indicated major excavating and filling activities have occurred across the subject site. 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 Phase 1 Preliminary Site Investigation are to:

1. Assess the current and former land use on the site for potentially contaminating activities.
2. If potentially contaminating activities are identified, undertake a preliminary soil investigation across the area of potential concern to assess the suitability of the proposed re-zoning site for the proposed 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 5 primary soil samples for petroleum hydrocarbons using a National Association of Testing Authorities (NATA) certified laboratory.
- Laboratory analysis of 2 composite + 1 discrete soil samples for metals 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, and results of the site inspection.
 - 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, COPC results were all below the investigation criteria.

Total Recoverable Hydrocarbons, Polycyclic Aromatic Hydrocarbons & BTEX results were all below the laboratory level of reporting (LOR) and, therefore, below the investigation criteria.

Imported fill material has been placed across the site and the results of a soil investigation show the fill material is suitable for use as Excavated Natural Material in accordance with the *Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 - the excavated natural material order 2014* and meets the Health Investigation Level, the Ecological Investigation Level and the Health Screening Level for residential land use as stated 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*.

No exceedances in concentrations of Metals/metalloids, Total Recoverable Hydrocarbons, Polycyclic Aromatic Hydrocarbons & BTEX were recorded.

Conclusion/Recommendations Summary

The Phase 1 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 13 Limitations.

The proposed rezoning site is generally vacant land. A review of available information and a detailed site inspection indicated the site had been used as a former quarry and since filled. Previous site investigations ruled out these activities as causing contamination. More recently ~500m² of unapproved fill material was brought onto the subject site, a potentially contaminating activity.

The area of imported fill was analysed for potential contaminants and the results revealed that samples collected during the implementation of the Soil and Analysis Quality Plan were all below the adopted investigation criteria for contaminants of potential concern for the proposed residential land use.

In relation to potential site contamination associated with the current and former land use, the proposed rezoning of the site to facilitate future urban purposes, primarily large lot residential development on Lot 16 DP 856265, 225 Terranora Road, Banora Point as shown in Appendix 2 of this report, would be suitable for the proposed residential land use.

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	3
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 Surrounding Area.....	9
2.2 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.....	12
4.1 Summary of Site Conditions	12
4.2 Site photographs.....	12
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.....	13
6 APPLICABLE INVESTIGATION LEVELS	13
6.1 Relevant Environmental Media	13
6.2 Soil	13
6.3 Investigation Criteria	13
6.4 Data Quality Objectives	15
7 SAMPLING AND ANALYSIS PLAN AND SAMPLING METHODOLOGY	17
7.1 Sampling, analysis and data quality objectives	17
7.2 Soil Sampling And Analysis Program	17
8 SOIL INVESTIGATION (FILL ASSESSMENT).....	18
9 INVESTIGATIONS.....	18
9.1 Fieldwork	18
9.2 Analytical Testing.....	18
9.3 Soil Program.....	18
9.4 Sampling Methodology and Quality Control	19
9.5 Primary Results.....	19
9.6 Statistical Analysis.....	20
9.7 Soil Investigation Conclusions	20
10 RESULTS OF ENVIRONMENTAL INVESTIGATIONS.....	20
10.1 Site specific Geology and Hydrogeology	20
10.2 Analytical Results.....	20
11 DISCUSSION	20
12 CONCLUSIONS AND RECOMMENDATIONS	20
13 LIMITATIONS.....	21
14 REFERENCES.....	22
15 GLOSSARY	23
16 APPENDICES.....	25
Appendix 1 Location Map.....	25
Appendix 2 Proposed Zoning Plan.....	26
Appendix 3 Sampling Locations.....	28

Appendix 4	Geology and Soil Landscape	30
Appendix 5	Cattle Dip Sites (TSC GIS)	32
Appendix 6	Historic Aerial Photography	33
Appendix 7	Historic Topographical Maps.....	38
Appendix 8	Historic Parish Maps.....	40
Appendix 9	Zone Map.....	43
Appendix 10	Site Photos.....	44
Appendix 11	Human Health Investigation Levels.....	47
Appendix 12	Laboratory Results Summary	49
Appendix 13	Chain of Custody.....	50
Appendix 14	Laboratory Result Certificates	52

LIST OF TABLES

Table 1 - Site Identification Summary	9
Table 2 – Site Characteristics.....	9
Table 3 – Aerial 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 Contaminants of Potential Concern (COPC) and Areas of Potential Concern (AOPC)	13
Table 8 - Investigation Criteria (Soil & Sediment).....	16
Table 9 – Sample locations and depth.....	18
Table 10 – Laboratory Results Summary	19

LIST OF FIGURES

Figure 1 - Surrounding Area (Source: NSW LPI).....	25
Figure 2 - Geology Map (Source dipnsw.gov.au).....	30
Figure 3 – Soil Landscape Map (Source: http://www.environment.nsw.gov.au/eSpadeWebApp/)	30
Figure 4 – Soil Landscape Map (Source: http://www.environment.nsw.gov.au/eSpadeWebApp/)	31
Figure 5 - Cattle Dip Sites (TSC GIS)	32
Figure 6 - Historical Aerial 1962 (TSC GIS)	33
Figure 7 – Historical Aerial 1970 (TSC GIS)	33
Figure 8 - Historical Aerial 1976 (TSC GIS)	34
Figure 9 – Historical Aerial 1987 (TSC GIS)	34
Figure 10 – Historical Aerial 1996 (TSC GIS)	35
Figure 11 – Historical Aerial 2003 (Google Earth)	35
Figure 12 – Historical Aerial 2009 (TSC GIS)	36
Figure 13 - Historical Aerial 2004 (TSC GIS)	36
Figure 14 - Historical Aerial 2016 (Google Earth)	37
Figure 15 - Historical Aerial 2017 (Google Earth)	37
Figure 16 – Topographical Map Extract (Tweed Heads) 1942.....	38
Figure 17 – Topographical Map Extract (Tweed Heads) 1974.....	38
Figure 18 – Topographical Extract (Tweed Heads) 2002	39
Figure 19 - Topographical Extract (Tweed Heads) 2016.....	39
Figure 20 – Parish Map Extract 1913.....	40
Figure 21 - Parish Map 1918.....	40
Figure 22 – Parish Map 1924	41
Figure 23 – Parish Map 1935	41
Figure 24 – Parish Map 1959	42
Figure 25 – NSW Legislation Zone Plan	43

Abbreviations/acronyms

ACM	Asbestos containing material
ANZECC	Australian and New Zealand Environment and Conservation Council
AoPC	Area of potential 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)
COPC	Contaminant of potential 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
RAP	Remedial Action Plan
SAQP	Sampling and analysis quality plan
Site	Lot 16 DP 856265, 225 Terranora Road, Banora Point
TCLP	Toxicity Characteristic Leaching Procedure

1 INTRODUCTION

1.1 Background

A planning proposal for part rezoning to large lot residential land is proposed on Lot 16 DP 856265, 225 Terranora Road, Banora Point, NSW, 2486. An initial assessment to meet the requirements of State Environmental Planning Policy No 55 *Remediation of Land* indicated the site has been extensively quarried prior to the 1970's and filled during the 1980's and in 2016.

HMC Environmental Consulting (HMC) was commissioned by Planit Consulting to undertake the required investigation and assess the proposed rezoning area for potential site contamination from current and former land use and ensure the provisions of SEPP 55 are satisfied. A Preliminary Site Investigation (PSI) including a desktop assessment of available information, and a detailed site inspection indicated fill material from an unknown source has been placed on site. As the fill may have been from a source subject to potentially contaminating activities, a Soil and Analysis Quality Plan (SAQP) was developed. The collected samples were assessed for concentrations of contaminants of potential concern (COPC) including petroleum hydrocarbons and metals.

1.2 Project Description

The proposed rezoning to large lot residential would extend along the southern side of Terranora Road near the Banora and Terranora villages on existing Lot 16 DP 856265, 225 Terranora Road, Banora Point, NSW, 2486. The site lies within the Terranora broad ridge with steep southern facing slopes generally clear of native vegetation.

1.3 Objectives

The objectives of the Preliminary Site Investigation are to:

1. Assess the current and former land use on the site for potentially contaminating activities.
2. If potentially contaminating activities are identified, undertake a preliminary soil investigation across the area of potential concern to assess the suitability of the proposed re-zoning 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.
- Laboratory analysis of 5 primary soil samples for petroleum hydrocarbons using a National Association of Testing Authorities (NATA) certified laboratory.
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 - summary of available land use history information, and results of the site inspection.
 - interpretation of laboratory results against relevant guidelines
 - suitability of site for current and proposed land use
 - conclusions and recommendations

2 SITE INFORMATION

2.1 Surrounding Area

The land is currently zoned as a deferred matter (DM) with a small northern section as large lot residential (R5) and a small southern portion as rural landscape (RU2). The site is bordered to the north by a dense residential area and to the south by the Tweed River. The land slopes steeply to the south with drainage directed towards the Tweed River. The site is generally cleared of native vegetation with the exception of the north western corner which is heavily vegetated.

2.2 Site Identification

Table 1 - Site Identification Summary

Street Address	225 Terranora Road Banora Point NSW 2486
Allotment size	10.19 Ha
Allotment Description	Lot 16 DP 856265
Property No.	37821
Local Government	Tweed Shire
Parish	Terranora
County	Rous
Zoning	DM – Deferred Matter RU2 – Rural Landscape R5 – Large Lot Residential
Land use - Existing	Vacant with 1 shed
Land use - Proposed	Residential and Rural
Site Services	Water and electricity
Surrounding land uses	Residential/Agricultural
Closest Sensitive Environment	Stormwater would flow south and downslope to the Tweed River which borders the site.

Table 2 – Site Characteristics

Topography <i>Tweed Heads 9641-4S Geopdf</i> Topographic map NSW Land & Property Information (2016)	The current topographic map indicates land use as <i>Open forest: 50-80% crown cover</i> with a <i>building, small</i> (known as shed) situated in the north eastern portion of the site. No cropping shown on subject site.
Regional Geology (Hashimoto et al 2008)	Bedrock geology tertiary volcanic (Tv): basalt, rhyolite, trachytes, gabbro and syenite & Cambro-Ordovician, Devonian and Carboniferous sedimentary rocks (Pzs), minor volcanic rocks (Central Block and Coffs Harbour Block)
Soil Landscape (Morand, 1996)	Billinudgel (bi) soil landscape (Expected), Yellow and Red Podzolics (GSG) or Chromosols (ASC). & Disturbed terrain, due to quarry activities
Site Drainage	Subject site is located on sloping, elevated land with a southern aspect towards the lower floodplain and the Tweed River.
Regional Hydrogeology TSC GIS	Groundwater vulnerability – High
Groundwater Database Search	The online NSW Office of Water groundwater mapping (http://allwaterdata.water.nsw.gov.au/water.stm) shows there are no registered groundwater bores within 500m of the subject site

3 SITE HISTORICAL REVIEW

A review of the title information via the online Land and Property Information portal on 2 October 2019 provides the following information:

Folio Description	Date of Folio	Ownership Details
16/856265	08/09/2018	WRENN PTY LTD

3.1 Aerial Photograph Interpretation

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

Table 3 – Aerial Summary

Year	Source	Comments	Areas of Potential Concern Yes/No
1962	Tweed Shire Council GIS	Roads and excavation occurring majorly throughout northern portion of proposed site.	YES
1970		Similar to 1962 with most of site excavated. No structures visible.	YES
1976		Similar to 1970, aerial not great quality.	YES
1987		Similar to 1976, quarry activities appear to be finished, vegetation present throughout northern portion of proposed site. Structures now visible to the north of proposed site	YES
1996		Site appears to have been filled with pasture grass established throughout disturbed site location.	YES
2003	Google Earth	Structure now visible to the north eastern portion of proposed site.	YES
2009		Similar to 2003, heavily vegetated areas surrounding previously disturbed land in the northern portion of the proposed site.	YES
2012		Similar to 2009. Second structure now visible lying approximately 100m from the southern boundary.	YES
2016-2017		Similar to 2012. Fill can be seen dumped in the north eastern portion of the proposed site.	YES

Land appears to have been used as a quarry throughout the late 60's and 70's being majorly cleared of vegetation and excavating the northern portion of the proposed site back to bedrock. A structure (shed) is visible in the aerial photography from 2003 located on the northern portion of the proposed site. A secondary structure appeared in 2012, this time at the southern end of the proposed site towards Tweed River. Approximately 500m² of fill material was imported onto the subject site in 2016, fill was placed south west of the existing shed.

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	The nearest mapped cattle dip sites is Terranora (Demolished) approximately 200m north west of the proposed site.

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: 1913, 1918, 1924, 1935, and 1959. http://images.maps.nsw.gov.au/pixel.htm	Maps do not record land use. Maps 1913 to 1959 show the development site is part of larger Portions 450 (27 acres) & 45 (40 acres) extending north and south of Terranora Road.
<ul style="list-style-type: none"> NSW Land & Property Information (2016) 1:25000 9641-4S Tweed Heads GeoPDF Topographic Map 	Land use; <i>Open forest: 50-80% crown cover with a building, small</i> (known as shed) situated in the north eastern portion of the site. No cropping shown on subject site.
<ul style="list-style-type: none"> NSW Land & Property Information (2002) 1:25000 9641-4S Tweed Heads Topographic Map 	Similar to 2016
<ul style="list-style-type: none"> NSW Dept of Lands (1974) 1:25000 9641-VI-S Tweed Heads Topographic Map 	Land use shown as <i>Quarry</i> with a <i>Road, sealed surface one way</i> established throughout the quarry. A <i>building</i> is visible on the southern boundary of the quarry margins. Vegetation surrounding the quarry shown as <i>medium timber</i> .
<ul style="list-style-type: none"> NSW Dept of Lands (1942) 1:63360 Tweed Heads Topographic Map 	Topographic map shows land use as <i>scattered timber</i> with <i>watercourse (non-perennial)</i> , sloping south towards Tweed River. No structures recorded on proposed site.

4 SITE INSPECTION

A site inspection was completed on 19th November 2019 by M Tunks & T Richards of HMC. Samples were collected to assess the presence of contaminants of potential concern (COPC) in the fill material.

4.1 Summary of Site Conditions

The proposed re-zoning site is located on elevated land, sloping south towards the Tweed River. Vegetation cover consists of native and exotic pasture grasses with scattered mature trees. A Preliminary Environmental Assessment completed in 2002 by Anembo Consultants under a previous development application (0152/2001DA) concluded that due to the high disturbance of the subject site the majority of flora species in the area are introduced weeds such as macaranga, blackwood and camphor laurels.

The site appears to have been used as a quarry around the 1970's, removing topsoil from the northern portion of the subject site. The site was filled with Kraznozem soil, clay loam topsoil, around the 1980's as an effort to fill in the extreme terracing of the site caused by quarry operations. Boreholes taken during the site inspection revealed little topsoil remains throughout the subject site. Fill was also brought onto the site in 2016, as shown by aerials, in the vicinity of the site. This fill was noted onsite and tested for COPC's.

The existing shed located in the vicinity of the subject site was visible in aerials from 2003. The shed was located onsite, no fuel or chemical storage areas/containers were recorded. Waste material (old metal, chairs, screens) lie scattered around the existing shed.

No soil staining, vegetative die-off or other indicators of spills/leaks of fuel or chemicals were noted on the site.

4.2 Site photographs

See Appendix 10

4.3 Possible Contaminant Sources and Potential Off-site Effects

Contamination was ruled out by Kieran Byrne and Associates in 2002 through a Geotechnical and Environmental Soil Assessment relating to the historical land use as a quarry and the importation of 0.3-0.5m of Kraznozem soil for fill throughout the subject site under 0152/2001DA for a proposed dwelling.

Possible contamination due to the importation of fill, as seen in the 2016 aerial. No potential off-site effects were noted at the time of the site inspection.

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. Pasture grass groundcover
Disturbed or distressed vegetation	No disturbed or distressed vegetation.
Surface water quality	No surface water present, elevated site.
Agrichemical Storage/Use	None recorded.
Other chemical/fuel storage	None recorded
Waste storage	A small stockpile of waste was scattered in the vicinity of the existing shed.
Asbestos Waste or Use in	None recorded

Structures	
Fill from unapproved source	Approximately 500m ² of fill material was imported in 2016 and placed within the subject site. Previous importation of fill (1980's) was tested in 2002 by Kieran Byrne & Associates and was found to comply with recognized thresholds.
Other	Nil

5.1 Identified Contaminants of Potential Concern

The northern portion of the subject site appears to have operated as a quarry in the 1970's. The extensive cutting and filling of land is considered a potentially contaminating activity. Results from a soil investigation revealed no COPC located within the site in 2002 (Kieran Byrne & Associates).

Fill was also imported onto the site in 2016 from an unknown source and may have been subject to potentially contaminating activities at source.

Table 7 - List of Contaminants of Potential Concern (COPC) and Areas of Potential Concern (AOPC)

COPC	Description and common relationship	Hotspot/AOPC
Total Recoverable Hydrocarbons, Polycyclic Aromatic Hydrocarbons & BTEX	Heavy machinery use, fuel storage	Land subject to former intensive excavation (quarry activities). Fill material from an unknown source identified onsite.
Heavy metals (arsenic (As), cadmium (Cd), copper (Cu), chromium (Cr), nickel (Ni), lead (Pb), zinc (Zn), mercury (Hg)) Laboratory heavy metal 8 suites completed.	Industrial, agricultural and domestic wastes. Heavy machinery uses and excavation & importation of soils.	

6 APPLICABLE INVESTIGATION LEVELS

6.1 Relevant Environmental Media

The relevant environmental media would be the approximately 500m² area of imported fill material located on-site.

6.2 Soil

The COPC were assessed using both the ENM criteria and the NEPM (2013) criteria for residential land use including HIL A and HSLs for residential land use. The fill material has previously been placed on the site, and the ENM exemption provided under the NSW EPA Waste Classification Guidelines relates generally to material being assessed prior to acceptance onto a site without an NSW EPA Environmental Protection Licence. The guidelines do provide conservative guidance on criteria for acceptance of fill material for residential land use. The ENM criteria for COPC are generally lower than the equivalent HIL or HSL as this relates to soil on the site and not subject to export off-site.

6.3 Investigation Criteria

The proposed rezoning has the potential to increase occupancy and, therefore, the exposure to COPC would be increased. Final exposure would depend on occupancy and exposure to the existing soil surface. The applicable exposure settings are:

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.

Health screening levels (HSLs) have been developed for selected petroleum compounds and fractions and are applicable to assessing human health risk via the inhalation and direct contact pathways. The HSLs depend on specific soil physicochemical properties, land use scenarios, and the characteristics of building structures. They apply to different soil types, and depths below surface to >4 m

The health screening levels adopted are for commercial land use 0m-<1m depth in clay.

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.**
- **Health Screening Level HSL A for Low Density Residential**

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 (1997) *Guidelines for Consultants Reporting on Contaminated Sites*** – were followed throughout the investigations and during preparation of this report.
- NSW DEC (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.’

The investigation criteria are based on the Health Investigation Level deemed relevant for the proposed land use in clayey soil. The Ecological Investigation Level is relevant within 2m of the ground surface.

Groundwater was expected to be at >3m depth on this elevated site with shallow bedrock. 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.

6.4 Data Quality Objectives

- **State the Problem**
 - Potential contaminants of concern associated with imported and unapproved fill in 2016.
- **Identify the Decisions/Goals**
 - Soil concentrations of COPC to meet adopted investigation criteria based on future land use.
- **Identify Information Inputs**
 - Soil organochlorine, organophosphate and metal concentrations,
 - Sampling depth and location (0-150mm based on NSW DEC (2005)).
 - Soil texture.
 - Field measurements - visual and olfactory
 - Investigation criteria generally based on residential land use for clay (fine) soil (<2m depth) as shown in table 8.
- **Define the Study Boundaries**
 - Investigation area is confined to the 500m² area of imported and unapproved fill material within the subject site as shown in Appendix 2 in this report. The land was formerly used as a quarry (>40 years ago and has since been filled) The NSW EPA Sampling design Guidelines (1995) require a minimum 7 sampling locations for this 500m² fill material area.
- **Develop the Analytical Approach**
 - If the results exceeded the investigation criteria, then the soil would require detailed investigation/remediation.
 - If the results were below the investigation criteria then the soil can remain in-situ and the site would be suitable for the proposed residential land use.
- **Specify the Acceptance Criteria**
 - Investigation criteria – maximum concentration - see table 8
- **Investigation Criteria**
 - See table 8
- **Optimise the Design**
 - Vary design based on site conditions and results

Table 8 - Investigation Criteria (Soil & Sediment)

Metals/Metalloids (mg/kg)	NEPM					ENM ⁽⁶⁾	
	HIL A ⁽¹⁾	HSL ⁽²⁾ (0-<1m depth)	EIL ⁽³⁾	ESL ⁽⁴⁾	Management Limits ⁽⁵⁾	Average	Maximum
Arsenic	100		100			20	40
Chromium	100 (VI)		400 (III)			75	150
Copper	6000		210			100	200
Nickel	400		270			30	80
Zinc	7400		270			150	300
Cadmium	20					0.5	1
Lead	300		1100			50	100
Mercury (inorganic)	40					0.5	1
Petroleum Hydrocarbons (mg/kg)							
Toluene		560		85		NA	65
Ethylbenzene		NL		70		NA	25
Xylene		130		105		NA	15
Naphthalene		6		10			
Benzene		0.8		50		NA	0.5
Benzo(a)pyrene		3		0.7		0.5.	1
F1 C6-C10		60		180	700		
F2 >C10-C16		330		120	1000		
F3 >C16-C34		-		300	3500		
F4 >C34-C40		-		2800	10000		
TPH C6-C36						250	500
Total Polycyclic Aromatic Hydrocarbons		300				20	40

- (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) Soil Health Screening Levels for Residential "A" land use (HIL A) as stated in Table 1A (3) 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
- (3) Ecological Investigation Levels (EILs) for Residential as stated in Tables 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
- (4) Ecological Screening Levels (ESLs) for Urban Residential as stated in Table 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
- (5) Management Limits (MLs) for Residential as stated in Table 1B(7) 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) Table 4 *Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 - The excavated natural material order 2014*

7 SAMPLING AND ANALYSIS PLAN AND SAMPLING METHODOLOGY

7.1 Sampling, analysis and data quality objectives

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

- To assess whether the concentrations of COPC within imported fill from an unknown source, meet the investigation criteria for ENM and residential 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.

Soil samples were collected using nitrile gloves either directly with clean stainless steel hand trowels. Samples were placed in 150mL laboratory supplied glass jars, cooled to <5°C, and transported to ALS Environmental laboratory in Brisbane.

7.2 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 the importation of unapproved fill material.

Unlike cultivated areas, there is no general land-use pattern for non-cultivated areas. Investigation of these areas will usually only be necessary where a contaminating activity has occurred. An area of fill was identified within the subject site, and a sampling pattern was adopted. Five (5) primary soil samples were collected from an approximate 500m² area that included the location of the unapproved fill within the proposed subject site.

Surface soil sampling was adopted as the site has been filled resulting in the clay soil generally binding the COPCs. Section 3.2.1 of the *Contaminated Sites - Guidelines for Assessing Former Orchards and Market Gardens* (DEC 2005) recommends a sampling depth interval of 0-150mm to assess arsenic, lead and DDT and aldrin/dieldrin concentrations.

A systematic grid sampling approach was completed as shown in Appendix 3.

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 Mark Tunks of HMC Environmental Consulting, with experience in site contamination investigations.
- Clean stainless steel trowels were used to collect samples from immediately below the root zone and detritus layer (0-150mm) using disposable nitrile gloves.
- Field quality assurance and quality control (QA/QC) protocols implemented included details of collection and analysis of field rinsate.
- 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.

8 SOIL INVESTIGATION (FILL ASSESSMENT)

As the approximate area subject to fill was estimated at 500m², a minimum 5 sampling locations was required under Table A of the NSW EPA *Contaminated Sites - Sampling Design Guidelines* and the *Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 - The excavated natural material order 2014*.

To assess the historic fill material, HMC visited the site to collect representative soil samples. The filled area is generally located in the north eastern portion of the site.

The fill material comprised of yellowish-brown clay loam material.

9 INVESTIGATIONS

9.1 Fieldwork

Systematic field sampling was conducted by an experienced environmental scientist on 19th November 2019. The sampled fill area is approximately 500m², a total of 5 primary samples were taken as well as 2 QA/QC samples and a rinsate:

Table 9 – Sample locations and depth

Composite ID	Depth (mm)
TR1A	0-150
TR2A	
TR3A	
TR4A	
TR5A	
TR6A	
TR7A	
TRRS1	-

A total of 5 primary soil samples were recovered and placed in laboratory supplied glass jars. The primary samples together with the QA/QC samples (2 x samples + 1 field rinsate) were transported to the HMC office for refrigerated storage prior to delivery to ALS Environmental laboratory for analysis for COPC.

9.2 Analytical Testing

Laboratory analytical services were provided by ALS Environmental Brisbane.

9.3 Soil Program

A total of 5 primary samples were submitted for analysis.

All samples were analysed for the following:

- Metals (arsenic, cadmium, chromium, copper, lead, nickel, mercury, zinc)
- Total Recoverable Hydrocarbons
- Polycyclic Aromatic Hydrocarbons
- BTEX

9.4 Sampling Methodology and Quality Control

Sampling was undertaken in accordance with the SAQP (see section 7).

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 14.

9.5 Primary Results

The laboratory analysis of the samples is summarised in table 10.

Total Recoverable Hydrocarbons, Polycyclic Aromatic Hydrocarbons & BTEX results were all below the laboratory level of reporting (LOR) for primary soil samples and, therefore, below the investigation criteria.

Arsenic results were all below the laboratory level of reporting (LOR) and, therefore, below the investigation criteria. Metal results were all below the Health Investigation Level for sensitive residential land use (HIL A).

No exceedances in concentrations of Metals/metalloids, Total Recoverable Hydrocarbons, Polycyclic Aromatic Hydrocarbons & BTEX were recorded.

Table 10 – Laboratory Results Summary

Parameter	Number of primary samples	PQL (mg/kg)	Criteria ⁽¹⁾ (HIL-A) (mg/kg)	Criteria Exceedances	Typical Background (Olszowy et al, 1995)
METALS/METALLOIDS					
Arsenic	7	5	100	0	5-53
Chromium	7	5	100 (VI)	0	5-56
Copper	7	5	6000	0	3-412
Nickel	7	5	400	0	5-38
Zinc	7	5	7400	0	5-92
Cadmium	7	1	20	0	nd
Lead	7	1	300	0	5-56
Mercury (inorganic)	7	1	40	0	nd
Total Recoverable Hydrocarbons					
>C10-C16	7		330	0	
>C16-C34	7		330	0	
>C34-C40	7		330	0	
Total >C10-C40	7		330	0	
Polycyclic Aromatic Hydrocarbons					
Napthalene	7		6	0	
Benzo-pyrene	7		3	0	
Total PAH	7		300	0	
BTEX					
Benzene (mg/kg)	7		0.8	0	
Toluene (mg/kg)	7		560	0	
Ethyl Benzene (mg/kg)	7		NL	0	
Total Xylenes	7		130	0	

- (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

9.6 Statistical Analysis

No statistical analysis was completed for the 19th November 2019 sampling round as the number of primary samples collected and analysed was <10.

9.7 Soil Investigation Conclusions

The Soil and Analysis Quality Plan was implemented and, results were all below the investigation criteria (HIL A) for Metals/metalloids, Total Recoverable Hydrocarbons, Polycyclic Aromatic Hydrocarbons & BTEX concentrations.

The QA/QC sample of 1 rinsate showed an elevated concentration in Total Recoverable Hydrocarbons, this concentration was still below the identified investigation criteria for residential areas (HIL A).

10 RESULTS OF ENVIRONMENTAL INVESTIGATIONS

10.1 Site specific Geology and Hydrogeology

The investigation recorded shallow clay loam soil in the upper part of the soil profile with bedrock lying beneath. No groundwater was intercepted or expected in the upper soil profile.

10.2 Analytical Results

All results from primary samples analysed were below the investigation criteria for residential areas (HIL A).

11 DISCUSSION

The review of available information and the site inspection did not generally indicate potentially contaminating activities have occurred on the site. Fill from an unknown source has been placed on the site. The land use on appears to have been commercial with the establishment of a quarry on the site in aerial photography from 1962 to 1987. Imported fill appears to have been placed on the site during 2016. As the source of the fill material was not known, a SAQP was developed with soil samples collected from the fill surface material. Laboratory analysis did not record contaminants of potential concern exceeding investigation criteria for the proposed residential land use. The site appears to be suitable for the proposed land use.

12 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 13 Limitations.

The proposed rezoning is confined to generally vacant land. A review of available information and a detailed site inspection indicated the site had been used as a former quarry and since filled. Previous site investigations ruled out these activities as causing contamination. More recently ~500m² of unapproved fill material was brought onto the subject site, a potentially contaminating activity.

The unapproved fill area was analysed for potential contaminants and the results revealed that samples collected during the implementation of the Soil and Analysis Quality Plan were all below the adopted investigation criteria for contaminants of potential concern for the proposed residential land use.

In relation to potential site contamination associated with the current and former land use, the proposed rezoning to enable future urban purposes, primarily large lot residential development on Lot 16 DP 856265, 225 Terranora Road, Banora Point NSW as shown in Appendix 2 of this report, would be suitable for the proposed residential land use.

13 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 Mark Tunks of HMC Environmental Consulting Pty Ltd.



.....

14 December 2019
Completion Date

Mark Tunks
Principal

14 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; and *Australian Standard AS 4482.2-2005* Guide to the sampling and investigation of potentially contaminated soil Part 1 - 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)

AS 2005, AS4482.1-2005: Guide to the Investigation and Sampling of Sites with Potentially Contaminated soil - Part 1: Non-volatile and semi-volatile compounds, Standards Australia, Sydney; available at www.standards.org.au

AS 1999, AS4482.2-1999: Guide to the Sampling and Investigation of Potentially Contaminated Soil - Part 2: Volatile substances, Standards Australia, Sydney; available at www.standards.org.au

EPA 1995, *Contaminated Sites: Sampling Design Guidelines*, 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.

15 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.

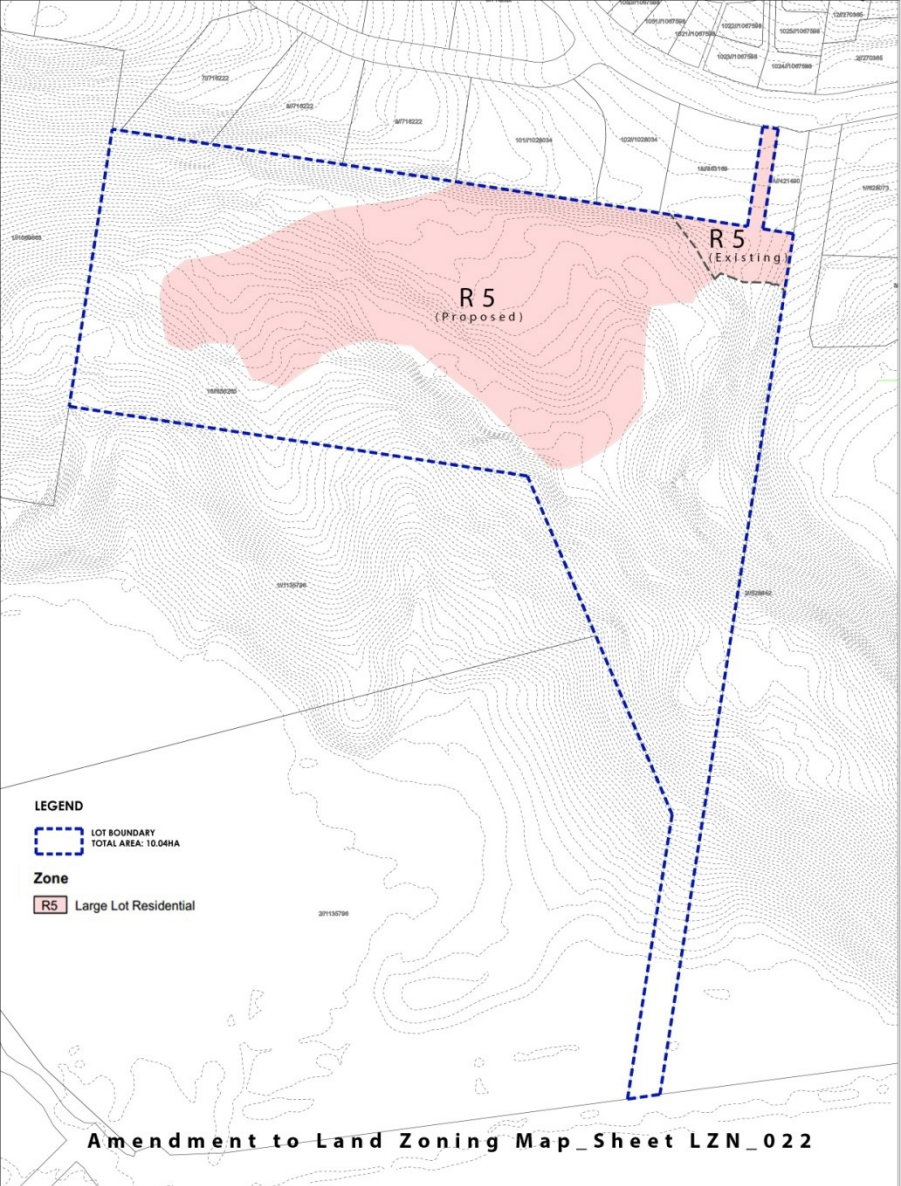
Appendix 1 Location Map



Figure 1 - Surrounding Area (Source: NSW LPI)

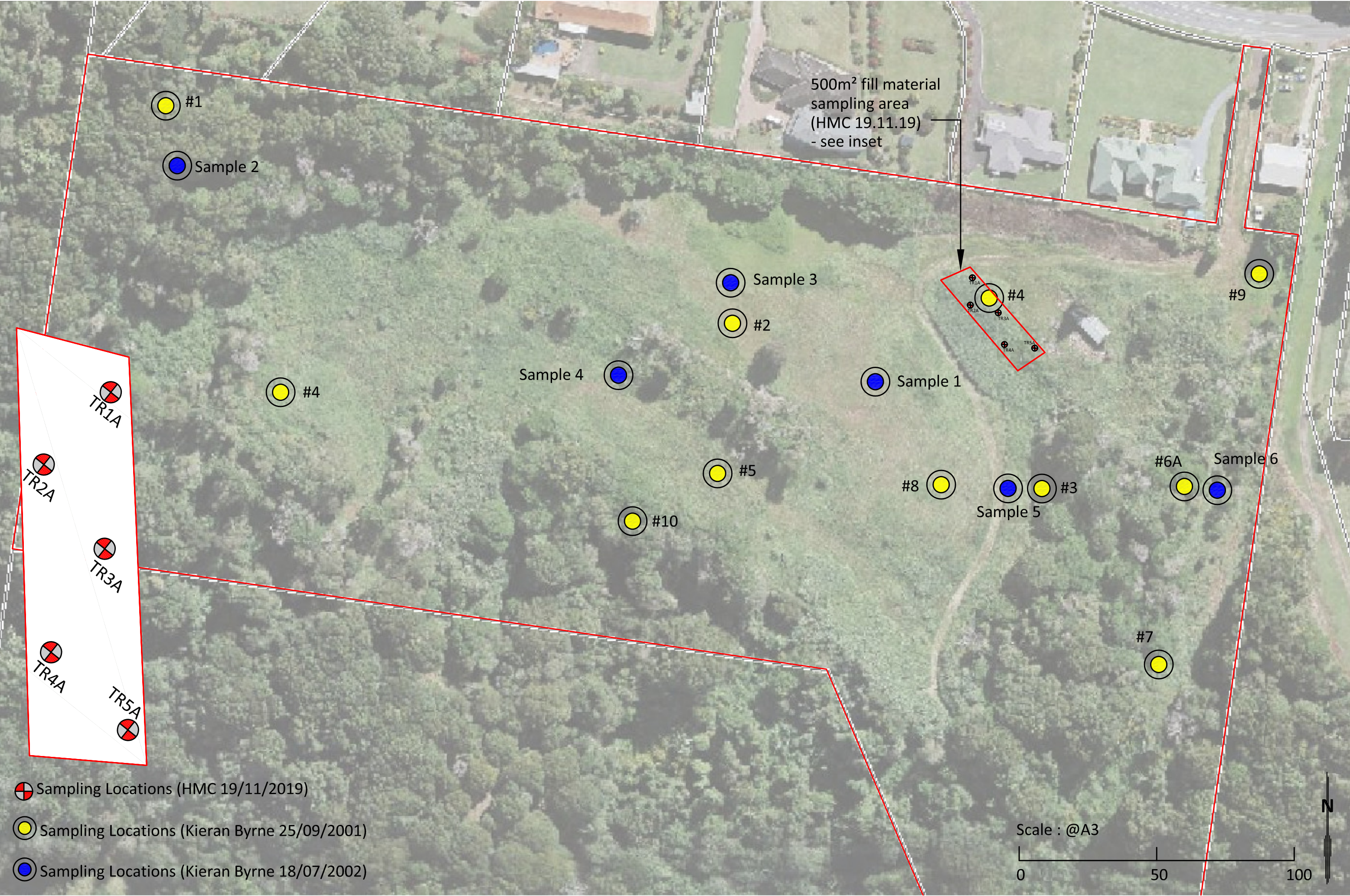
Appendix 2 Proposed Zoning Plan

SEE FOLLOWING PAGE



Appendix 3 Sampling Locations

SEE FOLLOWING PAGE



Appendix 4 Geology and Soil Landscape

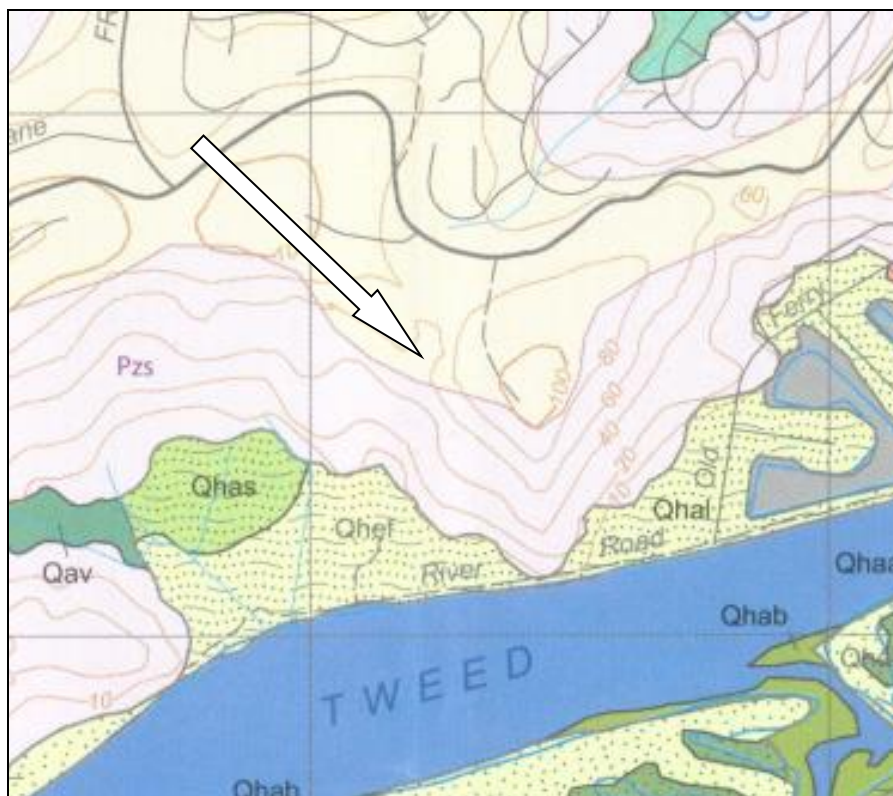


Figure 2 - Geology Map (Source dipnsw.gov.au)



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



Figure 4 – Soil Landscape Map (Source: <http://www.environment.nsw.gov.au/eSpadeWebApp/>)

Appendix 5 Cattle Dip Sites (TSC GIS)



Figure 5 - Cattle Dip Sites (TSC GIS)

Appendix 6 Historic Aerial Photography



Figure 6 - Historical Aerial 1962 (TSC GIS)



Figure 7 – Historical Aerial 1970 (TSC GIS)



Figure 8 - Historical Aerial 1976 (TSC GIS)



Figure 9 – Historical Aerial 1987 (TSC GIS)



Figure 10 – Historical Aerial 1996 (TSC GIS)

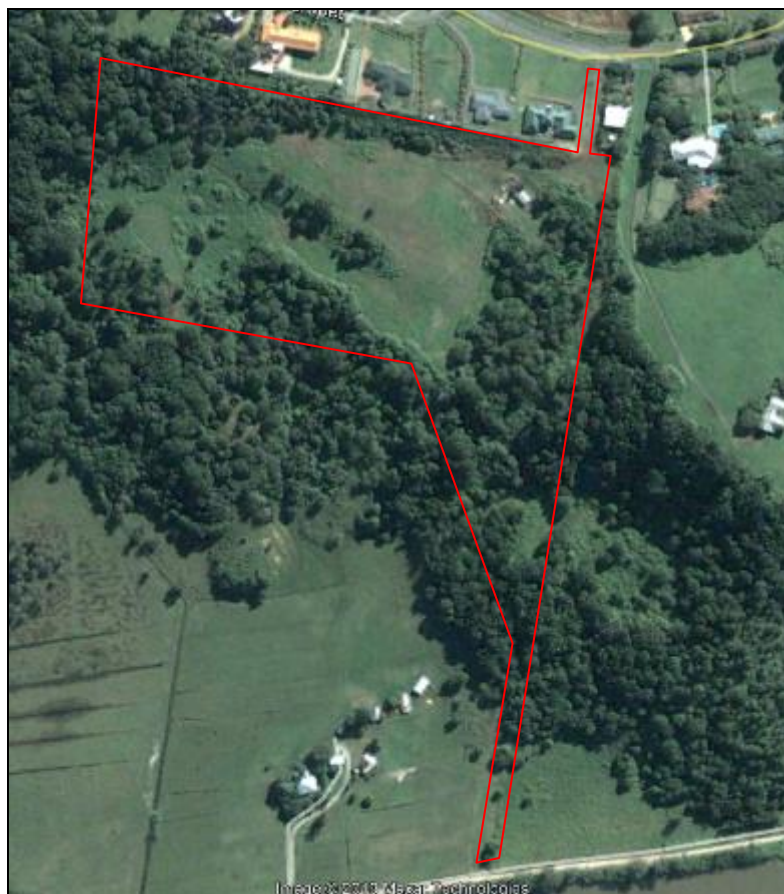


Figure 11 – Historical Aerial 2003 (Google Earth)



Figure 12 – Historical Aerial 2009 (TSC GIS)



Figure 13 - Historical Aerial 2004 (TSC GIS)



Figure 14 - Historical Aerial 2016 (Google Earth)



Figure 15 - Historical Aerial 2017 (Google Earth)

Appendix 7 Historic Topographical Maps



Figure 16 – Topographical Map Extract (Tweed Heads) 1942

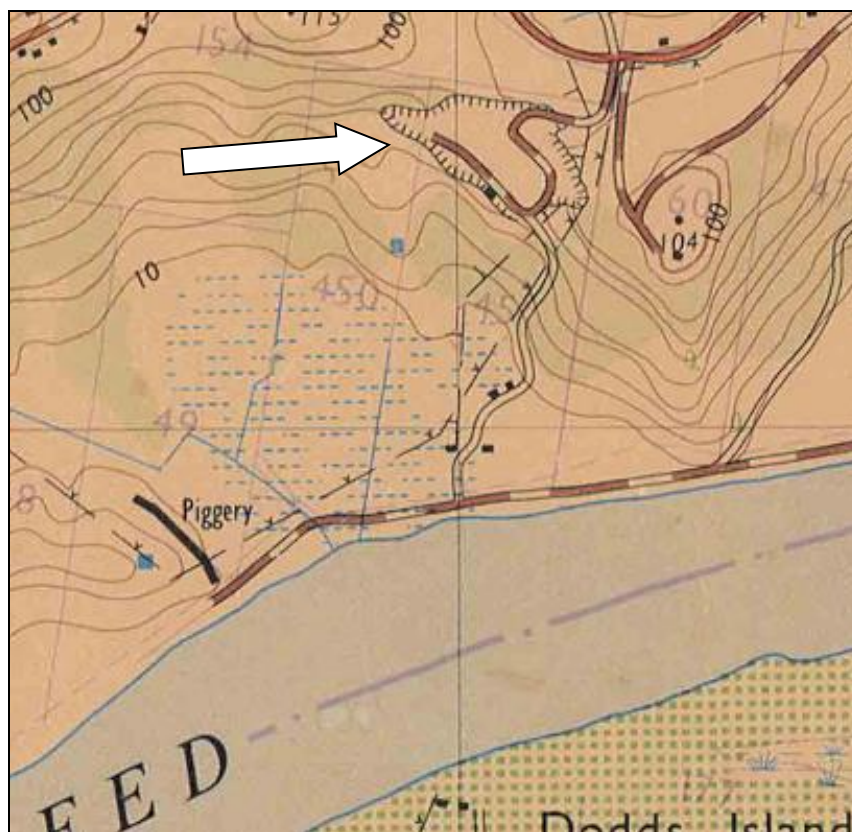
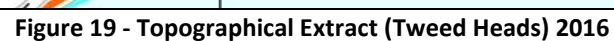
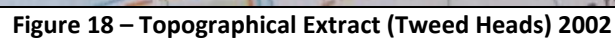


Figure 17 – Topographical Map Extract (Tweed Heads) 1974



Appendix 8 Historic Parish Maps

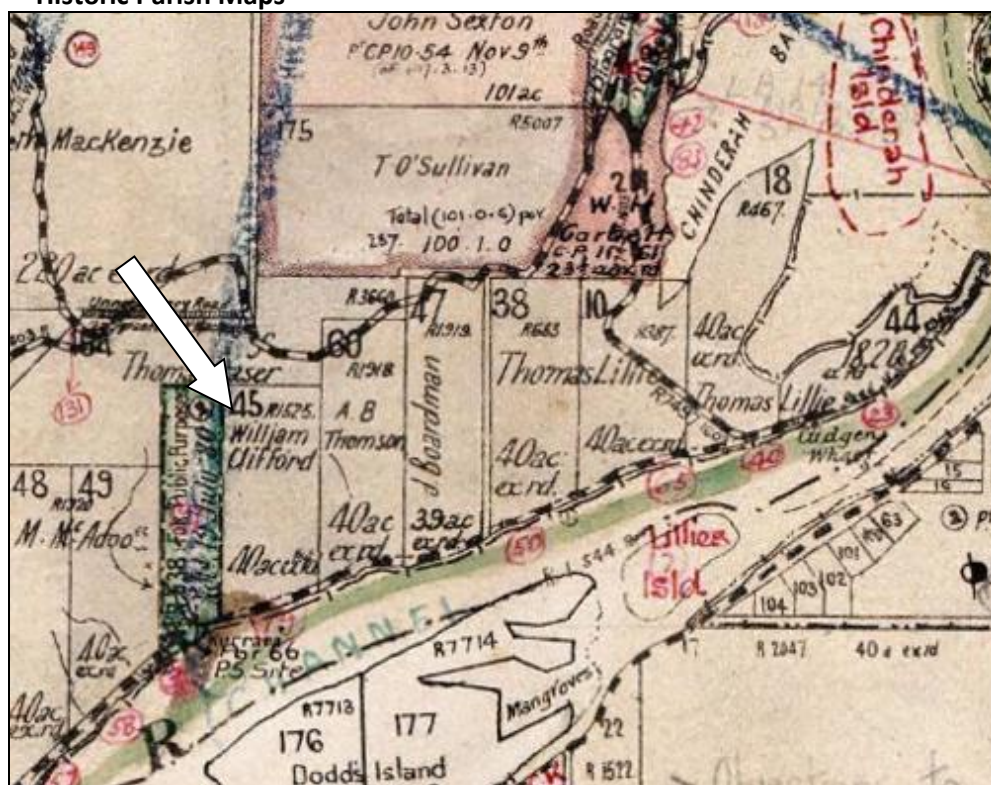


Figure 20 – Parish Map Extract 1913

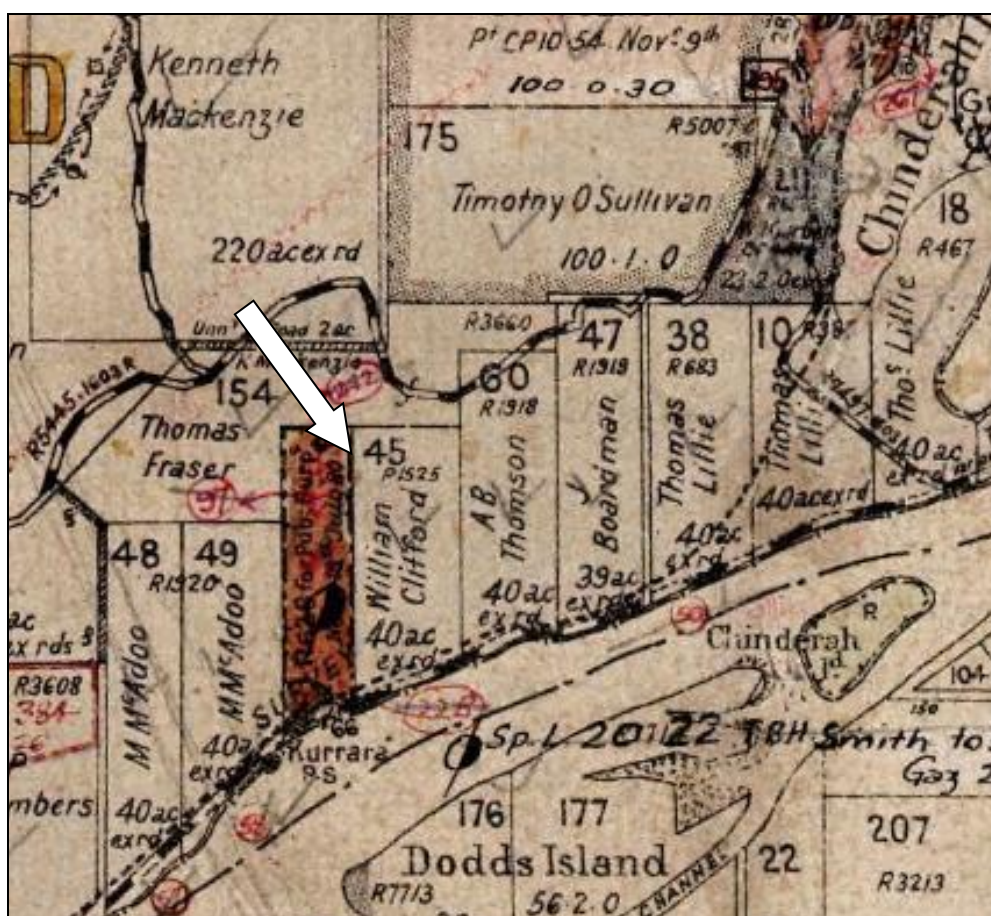


Figure 21 - Parish Map 1918



Figure 22 – Parish Map 1924

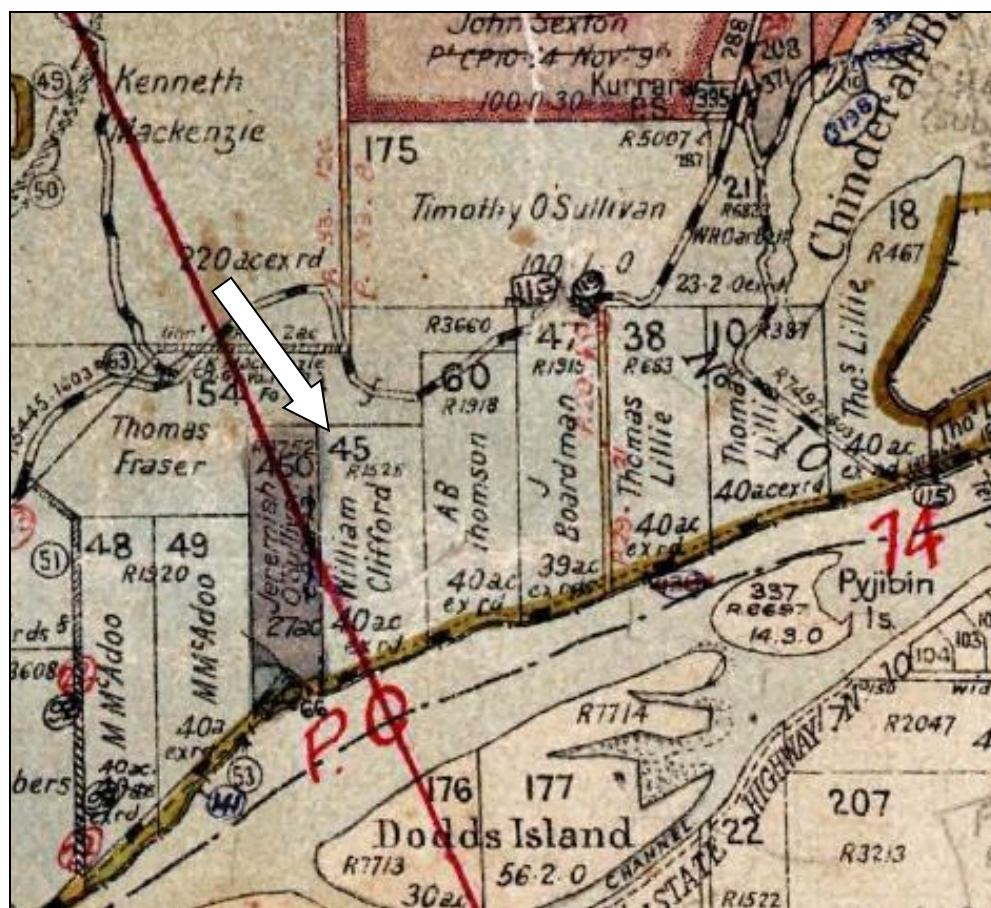


Figure 23 – Parish Map 1935



Figure 24 – Parish Map 1959

Appendix 9 Zone Map

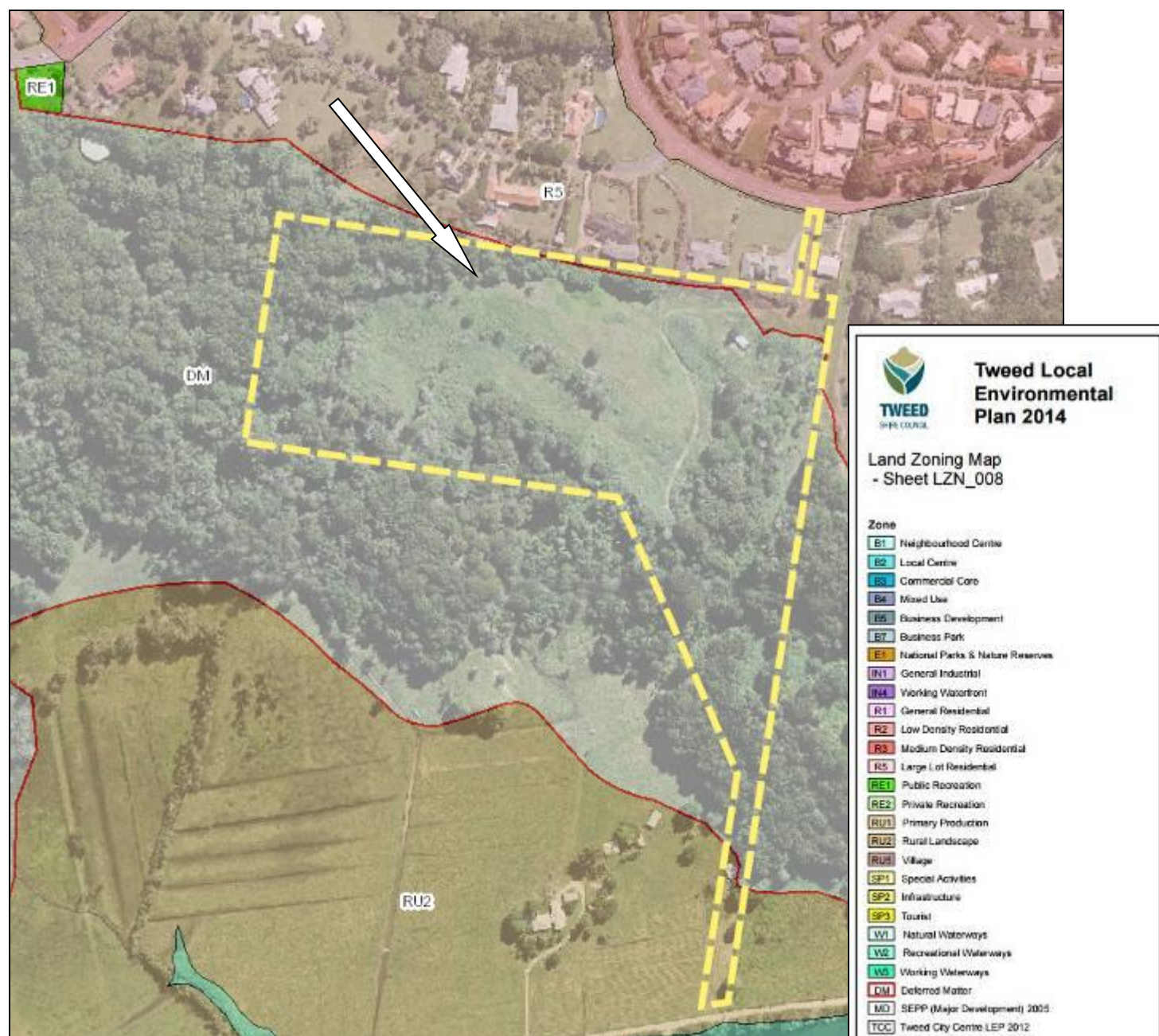


Figure 25 – NSW Legislation Zone Plan

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

Appendix 10 Site Photos



Photo 1 - View west and downslope across site



Photo 2 - View east and upslope across site.



Photo 3 – View NE towards existing shed.



Photo 4 - View south east along existing shed showing stockpile of rubbish.



Photo 5 – View NW showing stockpile of fill material.



Photo 6 – View south and downslope overlooking site.

Appendix 11 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
Chlorpyrifos	160	340	250	2000

Chemical	Health-based investigation levels (mg/kg)			
	Residential ¹ A	Residential ¹ B	Recreational ¹ C	Commercial/ industrial ¹ D
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 12 Laboratory Results Summary

Laboratory Results (8.10.2019)

Analyte								
	TR1A	TR2A	TR3A	TR4A	TR5A	TR6A	TR7A	TRRS1
Metals/Metalloids (mg/kg)								
Arsenic	<5	<5	<5	<5	<5	<5	<5	0.001
Chromium (total)	8	7	6	6	6	8	7	0.005
Copper	9	8	10	5	10	11	8	0.003
Nickel	4	5	5	4	4	5	4	0.001
Zinc	62	39	63	29	61	88	66	0.063
Cadmium	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.0001
Lead	10	9	14	<5	13	16	12	0.058
Mercury (inorganic)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.0001
Total Recoverable Hydrocarbons								
>C10-C16	<50	<50	<50	<50	<50	<50	<50	<100
>C16-C34	<100	<100	<100	<100	<100	<100	<100	130
>C34-C40	<100	<100	<100	<100	<100	<100	<100	<100
Total >C10-C40	<50	<50	<50	<50	<50	<50	<50	130
Polycyclic Aromatic Hydrocarbons								
Napthalene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
Benzo-pyrene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total PAH	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.5
BTEX								
Benzene (mg/kg)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1
Toluene (mg/kg)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
Ethyl Benzene (mg/kg)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
Total Xylenes	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2

Appendix 13 Chain of Custody

(SEE FOLLOWING PAGE)

Appendix 14 Laboratory Result Certificates

(SEE FOLLOWING PAGES)

CERTIFICATE OF ANALYSIS

Work Order : **EB1931285**
Client : **HMC ENVIRONMENTAL**
Contact : **MARK TUNKS**
Address : **SUITE 29, LEVEL 2 75-77 WHARF STREET**
TWEED HEADS 2485
Telephone : **+61 07 5536 8863**
Project : **225 Terranora Road, Terranora**
Order number : **2019.232**
C-O-C number : **----**
Sampler : **MARK TUNKS**
Site : **----**
Quote number : **EN/222**
No. of samples received : **7**
No. of samples analysed : **7**

Page : 1 of 9
Laboratory : Environmental Division Brisbane
Contact : Customer Services EB
Address : 2 Byth Street Stafford QLD Australia 4053
Telephone : +61-7-3243 7222
Date Samples Received : 21-Nov-2019 12:22
Date Analysis Commenced : 22-Nov-2019
Issue Date : 10-Dec-2019 14:52



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Mark Hallas	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Sarah Ashworth	Laboratory Manager - Brisbane	Brisbane Organics, Stafford, QLD
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TR1A	TR2A	TR3A	TR4A	TR5A
Client sampling date / time					19-Nov-2019 00:00	19-Nov-2019 00:00	19-Nov-2019 00:00	19-Nov-2019 00:00	19-Nov-2019 00:00
Compound	CAS Number	LOR	Unit		EB1931285-001	EB1931285-002	EB1931285-003	EB1931285-004	EB1931285-005
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		6.3	6.3	6.1	6.5	6.1
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		53	30	58	93	42
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		20.4	32.0	10.2	27.2	6.8
EG005(ED093)T-MW: Total Metals by nitric acid microwave digestion / ICP-AES									
Arsenic	7440-38-2	5	mg/kg		<5	<5	<5	<5	<5
Cadmium	7440-43-9	0.4	mg/kg		<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	7440-47-3	2	mg/kg		8	7	6	6	6
Copper	7440-50-8	5	mg/kg		9	8	10	5	10
Lead	7439-92-1	5	mg/kg		10	9	14	<5	13
Nickel	7440-02-0	2	mg/kg		4	5	5	4	4
Zinc	7440-66-6	5	mg/kg		62	39	63	29	61
EG035T-MW: Total Recoverable Mercury by nitric acid microwave digestion / FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup									
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP071 SG-S: Total Petroleum Hydrocarbons in Soil - Silica gel cleanup									
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TR1A	TR2A	TR3A	TR4A	TR5A
Client sampling date / time					19-Nov-2019 00:00	19-Nov-2019 00:00	19-Nov-2019 00:00	19-Nov-2019 00:00	19-Nov-2019 00:00
Compound	CAS Number	LOR	Unit		EB1931285-001	EB1931285-002	EB1931285-003	EB1931285-004	EB1931285-005
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	0.6	0.6	0.6	0.6
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	1.2	1.2	1.2	1.2
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		103	99.9	104	104	104
2-Chlorophenol-D4	93951-73-6	0.5	%		95.0	93.5	99.0	97.3	99.3
2.4.6-Tribromophenol	118-79-6	0.5	%		112	102	114	108	120
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		106	95.8	101	93.8	102
Anthracene-d10	1719-06-8	0.5	%		110	104	106	106	111
4-Terphenyl-d14	1718-51-0	0.5	%		138	130	128	130	132
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		73.2	78.4	116	86.5	88.8
Toluene-D8	2037-26-5	0.2	%		86.4	86.1	93.9	96.7	89.6
4-Bromofluorobenzene	460-00-4	0.2	%		90.4	87.0	96.0	90.9	73.4



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	TR6A	----	----	----	----
Client sampling date / time				19-Nov-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1931285-006	-----	-----	-----	-----
Result				----	----	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	6.4	----	----	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	68	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	34.1	----	----	----	----
EG005(ED093)T-MW: Total Metals by nitric acid microwave digestion / ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	----	----	----	----
Cadmium	7440-43-9	0.4	mg/kg	<0.4	----	----	----	----
Chromium	7440-47-3	2	mg/kg	8	----	----	----	----
Copper	7440-50-8	5	mg/kg	11	----	----	----	----
Lead	7439-92-1	5	mg/kg	16	----	----	----	----
Nickel	7440-02-0	2	mg/kg	5	----	----	----	----
Zinc	7440-66-6	5	mg/kg	88	----	----	----	----
EG035T-MW: Total Recoverable Mercury by nitric acid microwave digestion / FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	----	----
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup								
>C10 - C16 Fraction	----	50	mg/kg	<50	----	----	----	----
>C16 - C34 Fraction	----	100	mg/kg	<100	----	----	----	----
>C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	----	----	----	----
EP071 SG-S: Total Petroleum Hydrocarbons in Soil - Silica gel cleanup								
C10 - C14 Fraction	----	50	mg/kg	<50	----	----	----	----
C15 - C28 Fraction	----	100	mg/kg	<100	----	----	----	----
C29 - C36 Fraction	----	100	mg/kg	<100	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	----	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	----	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	----	----	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	----	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	----	----	----	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	----	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TR6A	----	----	----	----
Client sampling date / time					19-Nov-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1931285-006	-----	-----	-----	-----
				Result	----	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	----	----	----	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	----	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	----	----	----	----
Chrysene	218-01-9	0.5	mg/kg		<0.5	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	----	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	----	----	----	----
Dibenz(a,h)anthracene	53-70-3	0.5	mg/kg		<0.5	----	----	----	----
Benzo(g,h,i)perylene	191-24-2	0.5	mg/kg		<0.5	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	----	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	----	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	----	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	----	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	----	----	----	----
^ Total Xylenes	----	0.5	mg/kg		<0.5	----	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		106	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%		104	----	----	----	----
2,4,6-Tribromophenol	118-79-6	0.5	%		113	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		93.8	----	----	----	----
Anthracene-d10	1719-06-8	0.5	%		106	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		129	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		82.3	----	----	----	----
Toluene-D8	2037-26-5	0.2	%		88.5	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		90.3	----	----	----	----



Analytical Results

Sub-Matrix: **WATER**
 (Matrix: **WATER**)

Client sample ID

				TRRS1	----	----	----	----
Client sampling date / time				19-Nov-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1931285-007	-----	-----	-----	-----
				Result	----	----	----	----
EG020T: Total Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	0.005	----	----	----	----
Copper	7440-50-8	0.001	mg/L	0.003	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	0.058	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.063	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	----	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	----	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	----	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	----	----	----	----
Benzo(a)anthracene	56-55-3	1.0	µg/L	<1.0	----	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	90	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	120	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	210	----	----	----	----



Analytical Results

Sub-Matrix: **WATER**
 (Matrix: **WATER**)

Client sample ID

				TRRS1	----	----	----	----
Client sampling date / time				19-Nov-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1931285-007	-----	-----	-----	-----
Result				----	----	----	----	----

EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions

C6 - C10 Fraction	C6_C10	20	µg/L	<20	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	130	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	130	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	----	----	----	----

EP080: BTEXN

Benzene	71-43-2	1	µg/L	<1	----	----	----	----
Toluene	108-88-3	2	µg/L	<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	----	----	----	----
^ Total Xylenes	----	2	µg/L	<2	----	----	----	----
^ Sum of BTEX	----	1	µg/L	<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	----	----	----	----

EP075(SIM)S: Phenolic Compound Surrogates

Phenol-d6	13127-88-3	1.0	%	21.3	----	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%	62.3	----	----	----	----
2,4,6-Tribromophenol	118-79-6	1.0	%	36.2	----	----	----	----

EP075(SIM)T: PAH Surrogates

2-Fluorobiphenyl	321-60-8	1.0	%	55.9	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%	62.7	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%	72.2	----	----	----	----

EP080S: TPH(V)/BTEX Surrogates

1,2-Dichloroethane-D4	17060-07-0	2	%	90.7	----	----	----	----
Toluene-D8	2037-26-5	2	%	101	----	----	----	----
4-Bromofluorobenzene	460-00-4	2	%	111	----	----	----	----



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	35	154
2-Chlorophenol-D4	93951-73-6	42	153
2,4,6-Tribromophenol	118-79-6	26	157
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	34	156
Anthracene-d10	1719-06-8	37	153
4-Terphenyl-d14	1718-51-0	42	172
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	53	134
Toluene-D8	2037-26-5	60	131
4-Bromofluorobenzene	460-00-4	59	127

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	72
2-Chlorophenol-D4	93951-73-6	27	130
2,4,6-Tribromophenol	118-79-6	19	181
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	14	146
Anthracene-d10	1719-06-8	35	137
4-Terphenyl-d14	1718-51-0	36	154
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	66	138
Toluene-D8	2037-26-5	79	120
4-Bromofluorobenzene	460-00-4	74	118

CERTIFICATE OF ANALYSIS

Work Order : **ES1939042**
Client : **HMC ENVIRONMENTAL**
Contact : ADMIN ADDRESS
Address : SUITE 29, LEVEL 2 75-77 WHARF STREET
 TWEED HEADS 2485
Telephone : +61 07 5536 8863
Project : 225 Terranora Road, Terranora
Order number : 2019.232
C-O-C number : ----
Sampler : MARK TUNKS
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 : 26-Nov-2019 12:30
Date Analysis Commenced : 27-Nov-2019
Issue Date : 03-Dec-2019 13:57



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	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 the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by 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.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TR7A	----	----	----	----
Client sampling date / time					19-Nov-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1939042-001	-----	-----	-----	-----
				Result	----	----	----	----	----
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		6.3	----	----	----	----
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		81	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		27.6	----	----	----	----
EG005(ED093)T-MW: Total Metals by nitric acid microwave digestion / ICP-AES									
Arsenic	7440-38-2	5	mg/kg		<5	----	----	----	----
Cadmium	7440-43-9	0.4	mg/kg		<0.4	----	----	----	----
Chromium	7440-47-3	2	mg/kg		7	----	----	----	----
Copper	7440-50-8	5	mg/kg		8	----	----	----	----
Lead	7439-92-1	5	mg/kg		12	----	----	----	----
Nickel	7440-02-0	2	mg/kg		4	----	----	----	----
Zinc	7440-66-6	5	mg/kg		66	----	----	----	----
EG035T-MW: Total Recoverable Mercury by nitric acid microwave digestion / FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	----	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	----	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	----	----	----	----
Fluorene	86-73-7	0.5	mg/kg		<0.5	----	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	----	----	----	----
Anthracene	120-12-7	0.5	mg/kg		<0.5	----	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	----	----	----	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	----	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	----	----	----	----
Chrysene	218-01-9	0.5	mg/kg		<0.5	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	----	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	----	----	----	----



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	TR7A	----	----	----	----
Client sampling date / time					19-Nov-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1939042-001	-----	-----	-----	-----
				Result		----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	----	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C10 - C14 Fraction	----	50	mg/kg		<50	----	----	----	----
C15 - C28 Fraction	----	100	mg/kg		<100	----	----	----	----
C29 - C36 Fraction	----	100	mg/kg		<100	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
>C10 - C16 Fraction	----	50	mg/kg		<50	----	----	----	----
>C16 - C34 Fraction	----	100	mg/kg		<100	----	----	----	----
>C34 - C40 Fraction	----	100	mg/kg		<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	----	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	----	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	----	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	----	----	----	----
^ Total Xylenes	----	0.5	mg/kg		<0.5	----	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		91.6	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%		81.3	----	----	----	----
2,4,6-Tribromophenol	118-79-6	0.5	%		80.3	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		89.6	----	----	----	----
Anthracene-d10	1719-06-8	0.5	%		101	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		103	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.2	%		85.3	----	----	----	----
Toluene-D8	2037-26-5	0.2	%		101	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		99.9	----	----	----	----



Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2,4,6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130