



PRELIMINARY SITE INVESTIGATION

PROPOSED REZONING & SUBDIVISION

April 2023

WRENN PTY LTD

Lot 16 DP 856265
225 Terranora Road
Banora Point NSW

HMC2023.305

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

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.

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EXECUTIVE SUMMARY

BACKGROUND

A planning proposal for part rezoning and subdivision to large lot residential land is proposed for the property located at Lot 16 DP 856265, 225 Terranora Road, Banora Point NSW. It is proposed to rezone a large portion of the property to R5 Large Lot Residential and subdivide the land to create three residential lots, and a residual lot.

To address potential site contamination associated with current and former land use, HMC Environmental Consulting (HMC) was commissioned by Planit Consulting on behalf of the proponent Wrenn Pty Ltd, to undertake the required investigation in accordance with *State Environmental Policy (Resilience and Hazards) 2021 (SEPP 2021)*. A Preliminary Site Investigation (PSI) including a desktop assessment of available information, and a detailed site inspection was completed. The initial desktop investigation indicated that the site has been extensively quarried prior to the 1970's and filled during the 1980's and in 2016. As the fill may have been from a source subject to potentially contaminating activities, a Soil and Analysis Quality Plan (SAQP) was developed.

OBJECTIVES

The objectives of the Preliminary Site Investigation are to:

- Assess the current and former land use on the investigation area for potentially contaminating activities.
- Based on potentially contaminating activities associated with the current and former land use, assess the suitability of the investigation area 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 on the site including search of available records.
- Review of previous investigations.
- A detailed site inspection.
- Preparation of a Preliminary Site Investigation report including:
 - review of available land use history information, and results of the site inspection.
 - assessment of potentially contaminating activities, potential contaminants of concern (PCoC) and areas of concern (AoC).
 - preparation of a soil and analysis quality plan (SAQP).
 - collection of five primary soil samples (+ 2 x QA/QC samples) and laboratory analysis for potential contaminants of concern (PCoC) associated with fill material from an unknown source.
 - evaluation of laboratory results for compliance with investigation criteria.
 - conclusions and recommendations including suitability of the investigation area for the proposed development and need for further investigation and remediation.

CONCLUSIONS/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 14 Limitations.

A development application is proposed for the part rezoning and subdivision of the property located at Lot 16 DP 856265, 225 Terranora Road, Banora Point NSW. 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. In approximately 2016, ~500m² of unapproved fill material was brought onto the subject site, a potentially contaminating activity.

A Sampling and Analysis Quality Plan was prepared and implemented to assess total soil concentrations of potential contaminants of concern including petroleum hydrocarbons and metals, across the proposed development site and surrounds. Laboratory results recorded all petroleum hydrocarbons, along with arsenic, mercury and cadmium, below the laboratory level of reporting and, therefore, below the investigation criteria for residential land use. Other metal results were generally typical of background levels, and in all cases, below the investigation criteria. No further investigation is required.

Based on the information presented, in relation to potential site contamination associated with the current and former land use and fill material, the investigation area located Lot 16 DP 856265, 225 Terranora Road, Banora Point NSW, as shown in Appendix 1 and 2 of this report, is considered suitable for the proposed rezoning and subdivision.

Based on the information presented, in relation to potential site contamination associated with the current and former land use, no further investigation or remediation is required for the proposed rezoning and subdivision to be located at Lot 16 DP 856265, 225 Terranora Road, Banora Point NSW.

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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)
Client	Wrenn Pty Ltd
CLM Act	<i>Contaminated Land Management Act 1997</i>
CSM	Conceptual site model
DQO	Data quality objective
DSI	Detailed Site Investigation
EIL	Ecological Investigation Level
EPA	Environment Protection Authority
HIL	Health Investigation Level
HMC	HMC Environmental Consulting
Investigation Area	Proposed Subdivision area
mBGL	Metres below ground level
OEHS	[NSW] Office of Environment and Heritage
PCoC	Potential Contaminants of Concern
PSI	Preliminary Site Investigation
Site	Lot 16 DP 856265, 225 Terranora Road, Banora Point NSW
TLEP 2014	Tweed Local Environmental Plan 2014

1 INTRODUCTION

1.1 BACKGROUND

A planning proposal for part rezoning and subdivision to large lot residential land is proposed for the property located at Lot 16 DP 856265, 225 Terranora Road, Banora Point NSW. It is proposed to rezone a large portion of the property into R5 Large Lot Residential and subdivide to create three residential lots and a residual lot.

To address potential site contamination associated with current and former land use, HMC Environmental Consulting (HMC) was commissioned by Planit Consulting on behalf of the proponent Wrenn Pty Ltd, to undertake the required investigation in accordance with *State Environmental Policy (Resilience and Hazards) 2021 (SEPP 2021)*. A Preliminary Site Investigation (PSI) including a desktop assessment of available information, and a detailed site inspection was completed. The initial desktop investigation indicated that the site has been extensively quarried prior to the 1970's and filled during the 1980's and in 2016. As the fill may have been from a source subject to potentially contaminating activities, a Soil and Analysis Quality Plan (SAQP) was developed.

1.2 PROJECT DESCRIPTION

The proposal is seeking to rezone and subdivide the existing 10.19 hectare vacant property located at Lot 16 DP 856265, 225 Terranora Road, Banora Point NSW. There will be the part rezoning on the northern portion to R5 Large Lot Residential zone and subdivide into three residential lots and a residual lot. There new lots created would be:

- Lot 1: 10,000m²
- Lot 2: 10,000m²
- Lot 3: 21,816m²
- Residual Lot: 58,709m²

The new lots will be accessed from Terranora Road via a shared driveway from the northwest. The proposed residential lots are currently vacant of land uses and currently generally grass cover. A shed is existing on proposed Lot 3.

For the purposes of this report the investigation area would be generally confined to the proposed R5 zoned land which is proposed to be subdivided for residential development.

1.3 OBJECTIVE OF THE INVESTIGATION

The objectives of the Preliminary Site Investigation are to:

- Assess the current and former land use on the investigation area for potentially contaminating activities.
- Based on potentially contaminating activities associated with the current and former land use, assess the suitability of the investigation area 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 on the site including search of available records.

- Review of previous investigations.
- A detailed site inspection.
- Preparation of a Preliminary Site Investigation report including:
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 - assessment of potentially contaminating activities, potential contaminants of concern (PCoC) and areas of concern (AoC).
 - preparation of a soil and analysis quality plan (SAQP).
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 - evaluation of laboratory results for compliance with investigation criteria.
 - conclusions and recommendations including suitability of the investigation area for the proposed development and need for further investigation and remediation.

2 SITE INFORMATION

2.1 SITE IDENTIFICATION

Table 1 - Site Identification Summary

Street Address		225 Terranora Road, Banora Point NSW
Allotment Description		Lot 16 DP 856265
Allotment size		10.19 Hectares
Property Number		37821
Local Government		Tweed Shire
Parish		Terranora
County		Rous
Geographical Coordinates (MGA Zone 56)		Easting: 552182.04m E Northing: 6876578m S (Approximate centre of site).
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		Power, Water, On-site Sewage
Surround Land Uses	North	Urban Residential, Terranora Road.
	East	Urban Residential, Uncleared bushland (native or regrowth)
	South	Uncleared bushland (native or regrowth), agricultural (grazing) with residential.
	West	Uncleared bushland (native or regrowth), Residential.
Closest Sensitive Environment		Stormwater would flow south and downslope to the Tweed River which borders the site.

Table 2 – Site Characteristics

Topography	Subject site is located on sloping, elevated land with a southern aspect towards the lower floodplain and the Tweed River. Approximately 10-93m AHD across the property.
Regional Geology	<p>Cenozoic Mafic Volcanic Rocks Rocks which erupted from widespread volcanic activity over the last 65 million years. Includes basalt flows and eruptive products associated with the Tweed Volcano.</p> <p>Carboniferous Sedimentary Rocks A wide range of sedimentary rocks, including feldspar-rich sandstone, siltstone, mudstone, and conglomerate units.</p>
Soil Landscape	<p>Burringbar (bu) landscape: High rolling to steep hills on metamorphics of the Neranleigh-Fernvale Group.</p> <p>Soils: Shallow to moderately deep, moderately well-drained stony Grey Earths on crests and some slopes; deep, moderately well-drained Red Podzolic Soils on slopes of deeply weathered siltstone/mudstone/shale; shallow, poorly drained Yellow Podzolic Soils on slopes of quartzite/phyllite; deep, moderately well-drained Red Earths on foot slopes/lower slopes; imperfectly drained stony Yellow Podzolic Soils on old coastline.</p> <p>Geology: Jurassic Neranleigh-Fernvale Group. Predominantly phyllitic siltstones and shales, slaty in part. Quartzites and siliceous sandstones and siltstones are also present. Greywacke and argillite may occur in places.</p> <p>Disturbed Terrain (xx) landscape: Made land varying from level plains to undulating terrain which has been disturbed by human activity (historic quarry) to a depth of at least 100 cm. The original soil has been removed, greatly disturbed, or buried. Land fill includes soil, rock, building and waste material. The original vegetation has been completely cleared.</p>
Australian Soil Classification	<p>Kurosols (KU) Soils with strong texture contrast between A horizons and strongly acidic B horizons. Many of these soils have some unusual subsoil chemical features (high magnesium, sodium, and aluminium).</p>
Regional Hydrogeology	<p>Groundwater vulnerability is mapped as high.</p> <p>The site is elevated on the northern portion and therefore not expected to have shallow groundwater.</p>
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 HISTORY

3.1 OWNERSHIP

As of the search date, the property is currently owned by Wrenn Pty Ltd. A review of the title information via the online Land and Property Information portal on 29 March 2023 provides the following information:

Table 3 – Property Ownership

Folio Description	Date of Folio	Search Date	Ownership Details
16/856265	8/9/2018	29/3/2023	Wrenn Pty Ltd

3.2 AERIAL PHOTOGRAPH INTERPRETATION

A summary of the reviewed historic aerial photography is shown in Table 4.

Table 4 – Historic Aerial Photography 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.	
1976		Similar to 1970, aerial not great quality.	
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	
1996		Site appears to have been filled with pasture grass established throughout disturbed site location.	
2003	Google Earth	Structure now visible to the north-eastern portion of proposed site.	
2009		Similar to 2003, heavily vegetated areas surrounding previously disturbed land in the northern portion of the proposed site.	
2012		Similar to 2009. Second structure now visible lying approximately 100m from the southern boundary.	
2016-2017		Similar to 2012. Fill can be seen dumped in the north-eastern portion of the proposed site.	
2022	Nearmap	The property appears to be generally covered in grass with scattered vegetation. No intensive land uses noted.	

- (1) <https://portal.spatial.nsw.gov.au/portal/apps/webappviewer/index.html?id=f7c215b873864d44bccdda8075238cb>

Table 5 - 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 Ordinance Contaminated Sites http://www.defence.gov.au/uxo/where_is_uxo/UXOSearch.asp?State=NSW	No UXO sites are located near the investigation area.
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 is Terranora Dip (Remediated) located ~220m northwest from the investigation area.

3.3 HISTORIC PARISH MAPS & TOPOGRAPHIC MAPS

A summary of the available historic parish and topographic mapping information is shown in Table 6.

Table 6 - Historic Parish and Topographic Map Summary

Search	Comment
Historic Terranora Parish Maps 1913, 1918, 1924, 1935, and 1959 https://hlrv.nswlrs.com.au/	Maps do not record land use. Condong parish maps 1913 to 1959 show the subject site as part of the larger historic lots 450 (27 acres) and 45 (40 acres) extending north and south of Terranora Road. No changes were noted.
Topographic Maps	
<ul style="list-style-type: none"> Australian Section of the Imperial General Staff (1942), <i>N°213^A Zone 8 Tweed Heads</i>, 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.
<ul style="list-style-type: none"> <i>Department of Lands NSW (1974), 1:25000 9641-IV-S Tweed Heads</i>, 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 Land & Property Information (2002), <i>1:25000 9641-4S Tweed Heads</i>, Topographic Map 	Land use; <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.
<ul style="list-style-type: none"> NSW Land & Property Information (2016) <i>1:25000 9641-4S Tweed Heads</i>, GeoPDF Topographic Map 	Similar to 2002.

4 SITE INSPECTION

A number of site inspections have been completed on the site by HMC generally to assess on-site sewage management. A site inspection was completed on 19th November 2019 by M Tunks & T Richards of HMC to assess potential site contamination. An area of spoil was noted on the northern, central part of the site and samples were collected to assess the presence of potential contaminants of concern (PCoC) in the material.

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 Kraznozom 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 PCoC.

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.

4.1 Summary of site conditions

Table 7 provides a summary of observations during the site inspection.

4.2 Site photographs

See Appendix 10.

4.3 Site layout

The details of the site inspections are shown in Table 7.

4.4 Site features

Table 7 - 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 spoil was scattered on the northern, central part of the site..
Asbestos Waste or Use in Structures	None recorded
Fill from unapproved source	Approximately 500m ² of fill material was apparently 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 IDENTIFIED AREAS OF CONCERN AND 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 PCoC 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 8 - List of Potential Contaminants of Concern (PCoC) and Areas of Concern (AoC)

AoPC	PCoC	Description and common relationship
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)	Industrial, agricultural, and domestic wastes. Heavy machinery uses and excavation & importation of soils.
	Petroleum Hydrocarbons - benzene, toluene, ethyl benzene, xylene (BTEX), volatile and semi-volatile Total Recoverable Hydrocarbons (C6-C40), Polyaromatic hydrocarbons (PAH).	

6 APPLICABLE INVESTIGATION LEVELS AND INVESTIGATION CRITERIA

6.1 SOIL CRITERIA

The proposal would allow for residential development which would include increased occupancy on the property, and, therefore, increased exposure to PCoC may occur. Final exposure would depend on the presence, and concentration, of soil PCoC, and the likely use of the land. The applicable exposure settings for potential exposure of persons to soil, and soil disturbance associated with the potential land use, in and around the investigation area would be:

- **Health investigation level (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 level (EIL)** Urban residential/public open space is broadly equivalent to the HIL A, HIL B and HIL C land use scenarios.
- **Health Screening Levels (HSL A)** Low - high density residential (assessing fuel/oil contaminants only)
- **Ecological Screening Level (ESL)** Urban residential areas and public open space (assessing fuel/oil contaminants only)

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 (2022) *Sampling design part 1 - application-Contaminated Land guidelines* were followed during design of the sampling and analysis plan and predetermination of data quality objectives (DQOs).
- SEPP (2021) *State Environmental Planning Policy (Resilience and Hazards)*– provided guidance on project objectives.'
- NSW EPA (2020) *Consultants reporting on contaminated land - Contaminated land guidelines* 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.

Table 9 - Investigation Criteria (Soil & Sediment)

Analyte	HIL A ⁽¹⁾	EIL ⁽²⁾	HSL ⁽³⁾	ESL ⁽⁴⁾
Metals/Metalloids (mg/kg)				
Arsenic	100	100		
Chromium	100 (VI)	400 (III)		
Copper	6000	210		
Nickel	400	270		
Zinc	7400	270		
Cadmium	20			
Lead	300	1100		
Mercury (inorganic)	40			
BTEX (mg/kg)				
Benzene			0.6	65
Toluene			480	105
Ethyl Benzene			NL	125
Total Xylenes			110	45
Total Petroleum Hydrocarbons				
C6-C10			40	180
>C10-C16			230	120
>C16-C34				1300
>C34-C40				5600
Total >C10-C40				
Polyaromatic Hydrocarbons				
Napthalene			4	170
Benzo-pyrene				0.7

Carcinogenic PAHs (as BaP TEQ)				
Total PAH				

- (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 Residential 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
- (3) Health Screening Levels for clay in Tables 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
- (4) Ecological Screening Levels for clay in Tables 1B(6) 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 Ecological Screening levels

6.2 RELEVANT ENVIRONMENTAL MEDIA

Based on the site history, topography and soils, the relevant environmental media would generally be the surface soil, on and around the proposed secondary dwelling site, where soil might be disturbed during earthworks associated with the construction of the development, or subject to movement due to erosion (rain) or wind (dust). In this circumstance, the upper part of the soil profile would be most likely to be disturbed. The stockpiled material would also be disturbed during the development.

6.3 INVESTIGATION CRITERIA

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

Groundwater was expected to be at less than 5m depth near the investigation area with sandy clay soil. No groundwater investigation was completed during this preliminary investigation. If surface soil investigation recorded elevated PCoC exceeding investigation criteria then the groundwater regime would be further assessed and, if warranted, groundwater investigation, including collection of representative samples, would be implemented. No groundwater use for domestic purposes is proposed.

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.

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 PCoC to meet adopted investigation criteria based on future residential land use.
- Identify Information Inputs
 - Soil organochlorine, organophosphate, and metal concentrations, petroleum hydrocarbons (stockpiles only)
 - Sampling depth and location 0-150mm based on NSW EPA (2005) for disturbed areas]
 - 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 9
- 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 further investigation/remediation.
 - If the results were below the investigation criteria, then the soil can remain in-situ, and the investigation area would be suitable for the proposed residential land use.
- Specify the Acceptance Criteria
 - Investigation criteria – 95% UCL < HIL A & EIL, Standard Deviation <50% HIL A & EIL, maximum sample concentration <250% HIL A& EIL. - see Table 9
- Investigation Criteria
 - See Table 9
- Optimise the Design
 - Vary design based on site conditions and results.

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 PCoC 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.

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. 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*. 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 PCoC. 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 12.

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 M. Tunks & T. Richards of HMC Environmental Consulting, with experience in site contamination investigations on 19 November 2019.
- Dedicated, clean stainless-steel trowels were used to collect samples from immediately below the root zone and detritus layer, where present, (0-150mm) using disposable nitrile gloves.
- The trowels were decontaminated before sampling by pressure cleaning (12V) thoroughly with clean water, scrubbing with Decon 90 cleanser, and finally re-rinsing with clean water.
- Field quality assurance and quality control (QA/QC) protocols implemented included details of collection and analysis of field 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.

8 QUALITY ASSURANCE AND QUALITY CONTROL

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

Table 10 – Soil Quality Control Samples

Primary Sample ID	Type	Quality Control Sample ID	Laboratory	Analytes
TR3A	Duplicate	TR6A	ALS, Brisbane	Metals, BTEX. TRH, PAH
	Triplicate	TR7A	ALS, Brisbane	Metals, BTEX. TRH, PAH

The laboratory results and quality control reports include a description of the analytical methods used and reporting for surrogates used by ALS Environmental.

Table 11 - 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%	All soil results recorded an RPD within the prescribed limits.
Field duplicate RPDs within criteria	In accordance with AS4482.1 (2005), RPD results $\geq 50\%$ 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.	All field duplicate and triplicate <50% RPD or the results was 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%.	All results were all between 70-130%.
Surrogate spike sample results reported with prescribed limits	Limits set by the laboratory: Recoveries must lie between 50-150%.	Surrogate spike sample results reported within the 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 but rinsate collected prior to sampling to check HMC implement cleaning.
Sample blanks reported results below detection limits	Concentrations of targeted parameters to be below the laboratory's limit of reporting (LOR).	The sample blank results were below the 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.	Samples collected in accordance with regulatory and HMC procedures
Comparability		
Same standard operation procedures (SOPs) applied during each sampling event	The same SOPs to be adopted for each sampling event.	Same standard operation procedures (SOPs) 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)	SQP collected samples
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/triplicates reported
NATA stamp on reports	NATA stamps to be shown on all laboratory reports.	NATA stamp on reports

9 FIELD AND ANALYTICAL RESULTS

9.1 FIELDWORK

Systematic and strategic field sampling was conducted by experienced environmental scientists on 19 November 2019.

Table 12 – Sample Locations

Primary Sample	Location	Depth (mm)	ID	Soil Description	Laboratory Program
TR1A	Systematic surface sampling across the extent of the fill material (500m ²)	0 - 150mm	Primary	Yellowish-brown clay loam	Metals, BTEX, TRH, PAH
TR2A					
TR3A					
TR4A					
TR5A					
TR6A	QA/QC Samples		Duplicate QA/QC		
TR7A			Triplicate QA/QC		

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

Refer to Appendix 12 for the site plan and sampling locations.

9.2 ANALYTICAL TESTING

Laboratory analytical services were provided by ALS Environmental, Brisbane.

9.3 SOIL PROGRAM

A total of 5 primary samples were taken across the investigation area and submitted for analysis for the following:

- Metals - arsenic (As), cadmium (Cd), copper (Cu), chromium (Cr), nickel (Ni), lead (Pb), zinc (Zn), mercury (Hg)
- Petroleum Hydrocarbons – benzene, toluene, ethyl benzene, xylene (BTEX), volatile and semi-volatile Total Recoverable Hydrocarbons (C6-C40), Polyaromatic hydrocarbons (PAH)

9.4 PRIMARY AND REPLICATE RESULTS

The laboratory analysis of the selected primary samples is summarised in Table 13.

Table 13 – Laboratory Results Summary (8 February 2023)

Parameter	Number of primary samples	LOR (mg/kg)	Criteria Exceedances	Range (mg/kg)	Typical Background (Olszowy et al, 1995) mg/kg
Metals/Metalloids					
Arsenic	7	5	0	<5	5-53
Chromium	7	2	0	6 – 8	5-56
Copper	7	5	0	5 – 10	3-412
Nickel	7	2	0	4 – 5	5-38
Zinc	7	5	0	29 – 63	5-92
Cadmium	7	1	0	<0.4	nd
Lead	7	5	0	<5 – 14	5-56
Mercury (inorganic)	7	0.1	0	<0.1	nd
BTEX					
Benzene (mg/kg)	7	0.2	0	<0.2	
Toluene (mg/kg)	7	0.5	0	<0.5	
Ethyl Benzene (mg/kg)	7	0.5	0	<0.5	
Total Xylenes	7	0.5	0	<0.5	
Total Petroleum Hydrocarbons					
C6-C10	7	10	0	<10	
>C10-C16	7	50	0	<50	
>C16-C34	7	100	0	<100	
>C34-C40	7	100	0	<100	
Total >C10-C40	7	50	0	<50	
Polyaromatic Hydrocarbons					
Napthalene	7	0.5	0	<0.5	
Benzo-pyrene	7	0.5	0	<0.5	
Total PAH	7	0.5	0	<0.5	

* **Bold** indicates a criteria exceedance

10 QA/QC LABORATORY DATA REVIEW

10.1 RELATIVE PERCENT DIFFERENCE (RPD)

The results show very good correlation between the primary sample (TR3A) and the field replicate (TR6A) with all results below 50% RPD or less than 10 times the LOR. The results also show generally very good correlation between the TR3A and the triplicate (TR7A) sample.

10.1.1 Rinsate

There were very slight detections of metals and total recoverable hydrocarbons, however the levels are not indicative of cross contamination and were generally below the laboratory level of reporting (LOR).

10.1.2 Statistical Analysis

All PCoC results (total concentrations) for the investigation area were below the investigation criteria and therefore statistical analysis was not required.

10.2 SOIL INVESTIGATION CONCLUSIONS

The Soil and Analysis Quality Plan was implemented, and 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, mercury and cadmium 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.

11 CONCEPTUAL SITE MODEL

Table 14 - Conceptual Site Model

POTENTIAL SOURCE	PATHWAY	EXPOSURE ROUTE	RECEPTOR	OUTCOME
Land subject to former intensive excavation (quarry activities). Fill material from an unknown source identified onsite.	Surface water runoff	Chemical/sediment entering local water ways	Ecological receptors	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. However, the soil investigation for the site recorded contaminant results all below the investigation criteria.
	Exposed surface soil	Dermal contact to exposed soil during earthworks, proposed building occupation and recreational use	Site worker, Occupier, Visitor	
	Atmospheric dispersion	Inhalation of soil exposed during earthworks and in exposed bare soil areas		
	Leaching to groundwater	Groundwater movement off-site to beneficial users or ecological receptors	Beneficial users/Ecological receptor	

12 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.

13 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 14 Limitations.

A development application is proposed for the part rezoning and subdivision of the property located at Lot 16 DP 856265, 225 Terranora Road, Banora Point NSW. 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. In approximately 2016, ~500m² of unapproved fill material was brought onto the subject site, a potentially contaminating activity.

A Sampling and Analysis Quality Plan was prepared and implemented to assess total soil concentrations of potential contaminants of concern including petroleum hydrocarbons and metals, across the proposed development site and surrounds. Laboratory results recorded all petroleum hydrocarbons, along with arsenic, mercury and cadmium, below the laboratory level of reporting and, therefore, below the investigation criteria

for residential land use. Other metal results were generally typical of background levels and, in all cases, below the investigation criteria. No further investigation is required.

Based on the information presented, in relation to potential site contamination associated with the current and former land use and fill material, the investigation area located Lot 16 DP 856265, 225 Terranora Road, Banora Point NSW, as shown in Appendix 1 and 2 of this report, is considered suitable for the proposed rezoning and subdivision.

Based on the information presented, in relation to potential site contamination associated with the current and former land use, no further investigation or remediation is required for the proposed rezoning and subdivision to be located at Lot 16 DP 856265, 225 Terranora Road, Banora Point NSW.

14 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.

15 SIGNATURE

This report has been prepared by Mark Tunks of HMC Environmental Consulting, a suitably qualified environmental consultant, in accordance with the NSW EPA (2020) *Consultants reporting on contaminated land – Contaminated land guidelines*. Note that HMC Environmental Consulting holds current Professional Indemnity Insurance to 4th August 2023.



Mark Tunks
Principal

3 April 2023
Completion Date

16 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

Hashimoto T.R & Troedson A.I. 2008 *Tweed Heads 1:100 000 and 1:25 000, Coastal Quaternary Geology Map Series*. Geological Survey of New South Wales, Maitland

Morand, D.T., Soil Landscapes of the Murwillumbah-Tweed Heads 1:100 000 Sheet, 1996

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

NSW Environment Protection Authority (2020) Consultants reporting on contaminated land - Contaminated land guidelines.

State Environmental Planning Policy (Resilience and Hazards) 2021

17 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.

18 APPENDICES

APPENDIX 1 - LOCATION MAPS



Figure 1 - Surrounding Area (Source: Nearmap 2022)



Figure 2 – Subject Site (Source: Nearmaps 2022)

APPENDIX 2 - SITE PLAN PROPOSED DEVELOPMENT





Project _____

CONCEPT PLAN


Client _____
Wrenn Pty Ltd

[illegible]

Approval Details

APPROVAL NO: 00000

Scale Bar

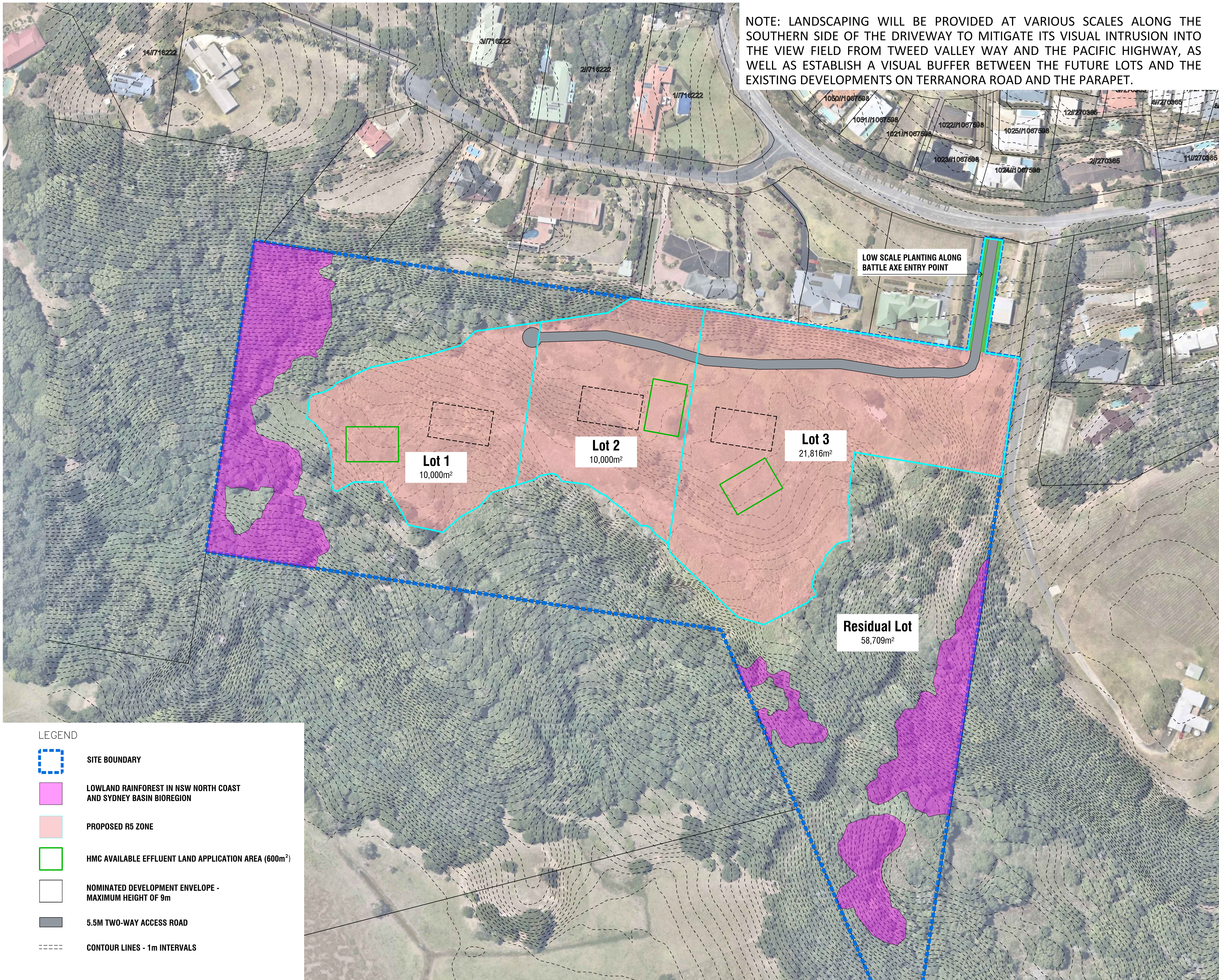


10 0 10 20 30 40 50 metres

SCALE 1:1000 @ A1 1:2000 @ A3

N

Drawing No. 001 Rev No. 04



APPENDIX 3 - GEOLOGY AND SOIL LANDSCAPE

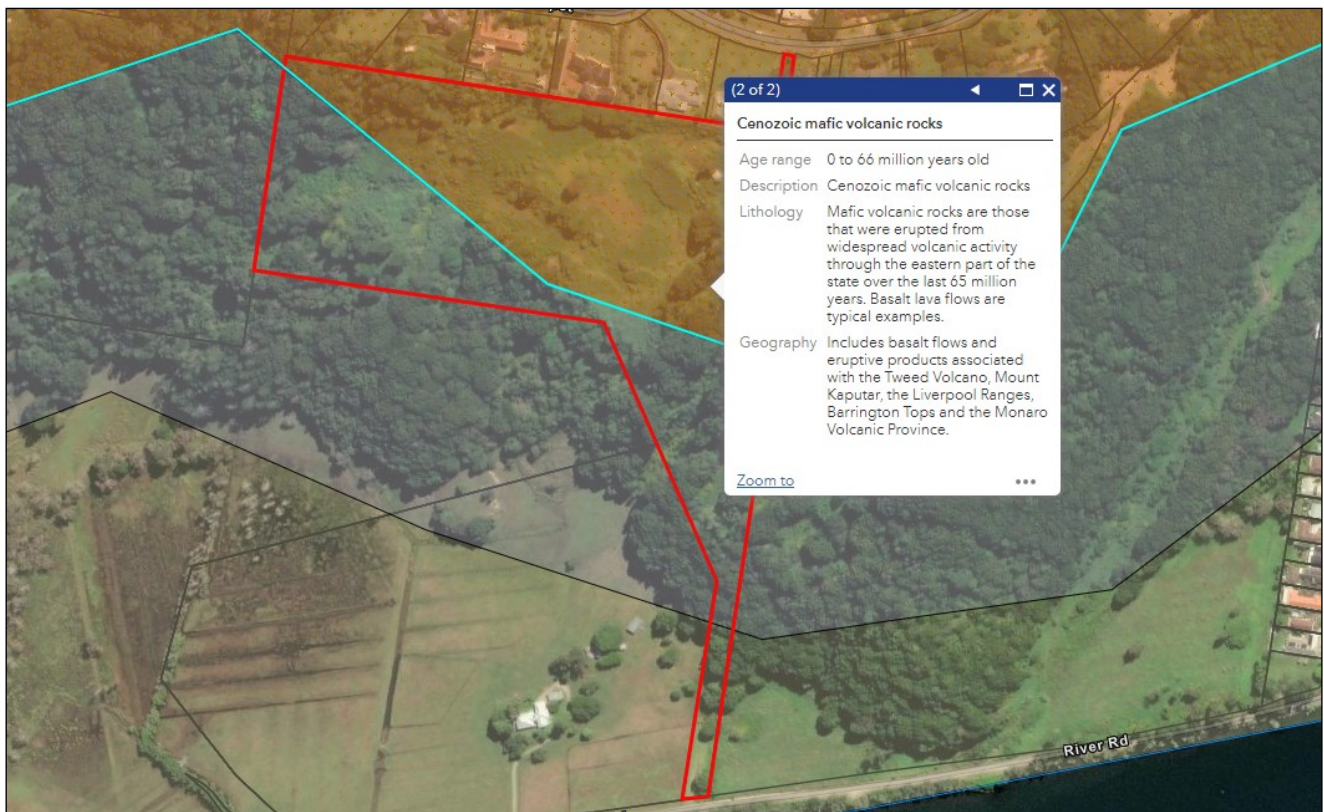


Figure 3 - Geology Map (Source: Geoscience Australia)

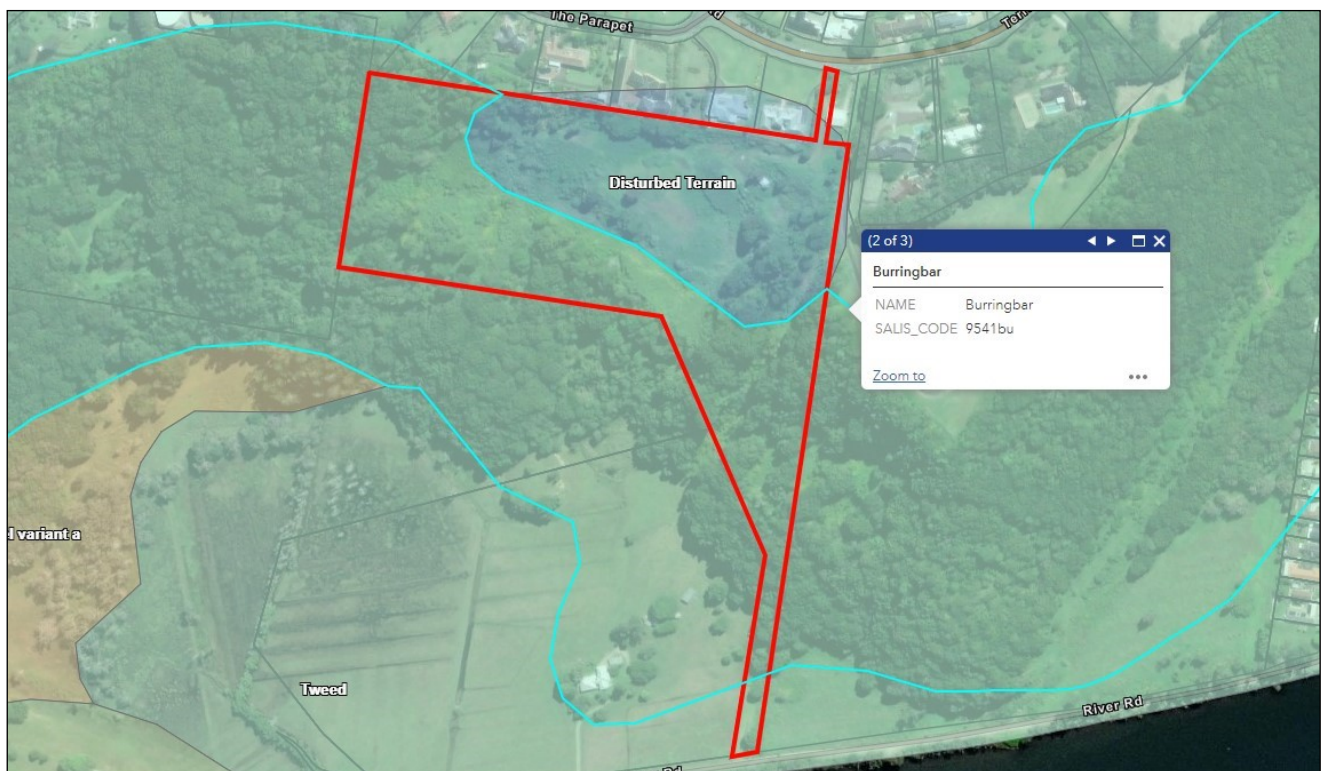


Figure 4 - Soil Landscape (Source: eSPADE NSW)

APPENDIX 4 - LICENSED GROUNDWATER BORES



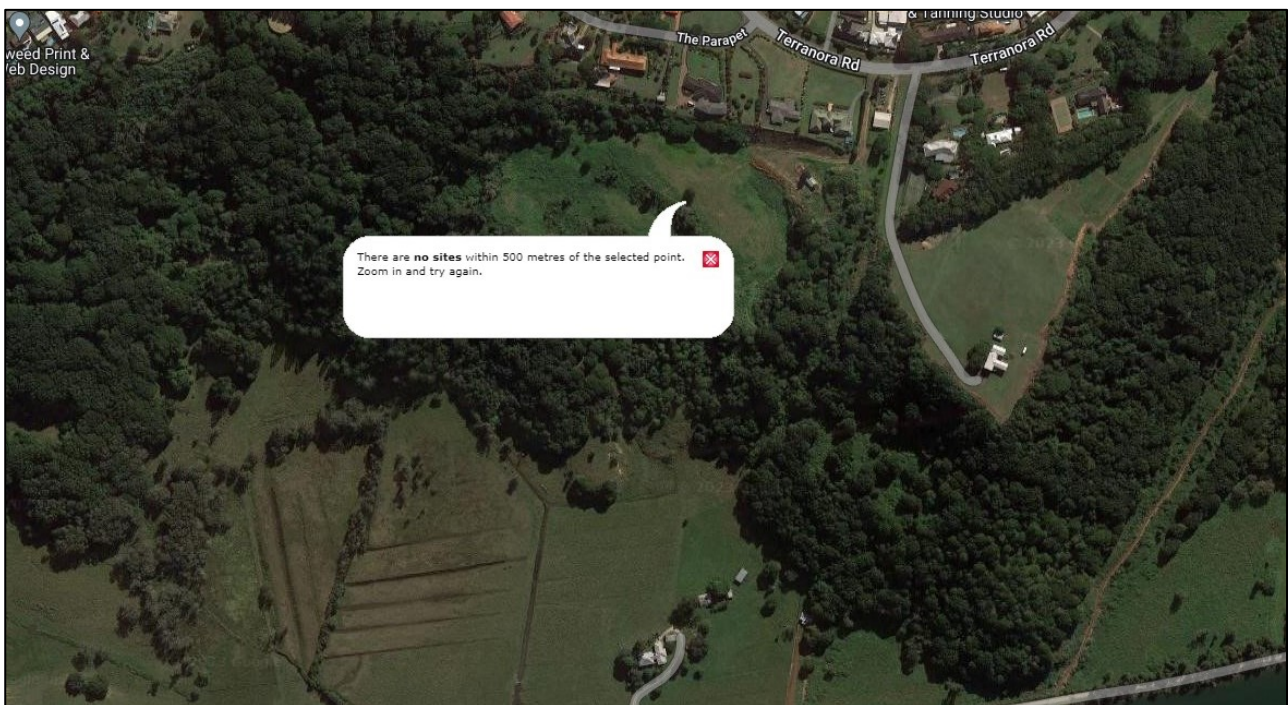


Figure 5 – Groundwater Bore Locations (Source: <http://allwaterdata.water.nsw.gov.au/water.stm>)

APPENDIX 5 - CATTLE DIP SITES



Figure 6 – Cattle Dip Locations (Source: HMC GIS)

APPENDIX 6 - HISTORICAL AERIAL PHOTOGRAPHY





Figure 7 - Historical Aerial 1962 (TSC GIS)



Figure 8 – Historic Aerial 1970 (TSC GIS)



Figure 9 - Historical Aerial 1976 (TSC GIS)



Figure 10 – Historic Aerial 1987 (TSC GIS)



Figure 11 - Historical Aerial 1996 (TSC GIS)

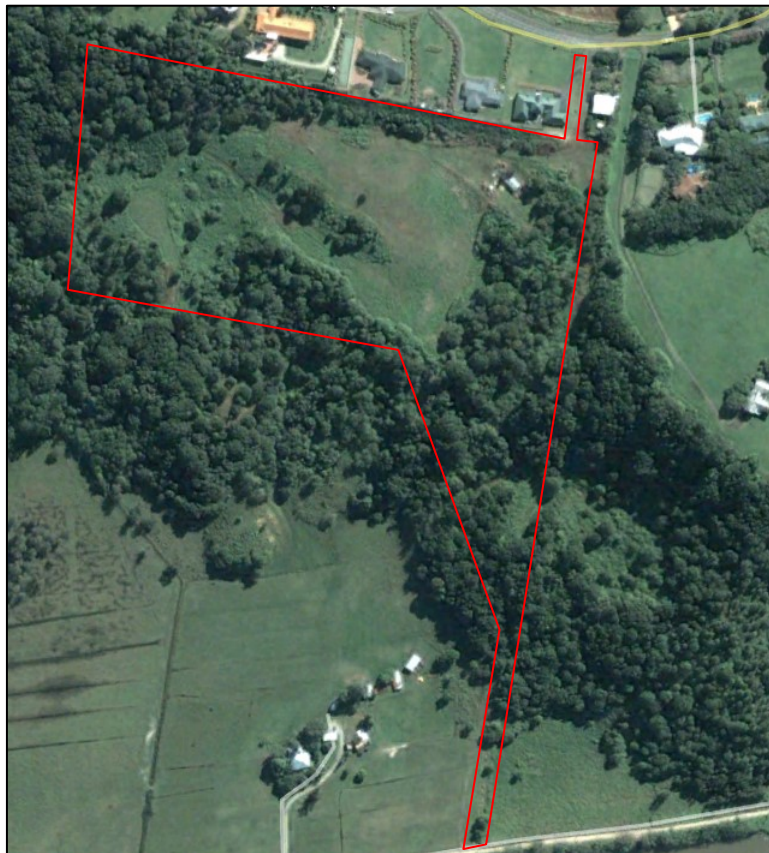


Figure 12 – Historic Aerial 2003 (TSC GIS)



Figure 13 – Historic Aerial 2016 (TSC GIS)



Figure 14 – Historic Aerial 2022 (Nearmap)

APPENDIX 7 - HISTORIC PARISH MAPS

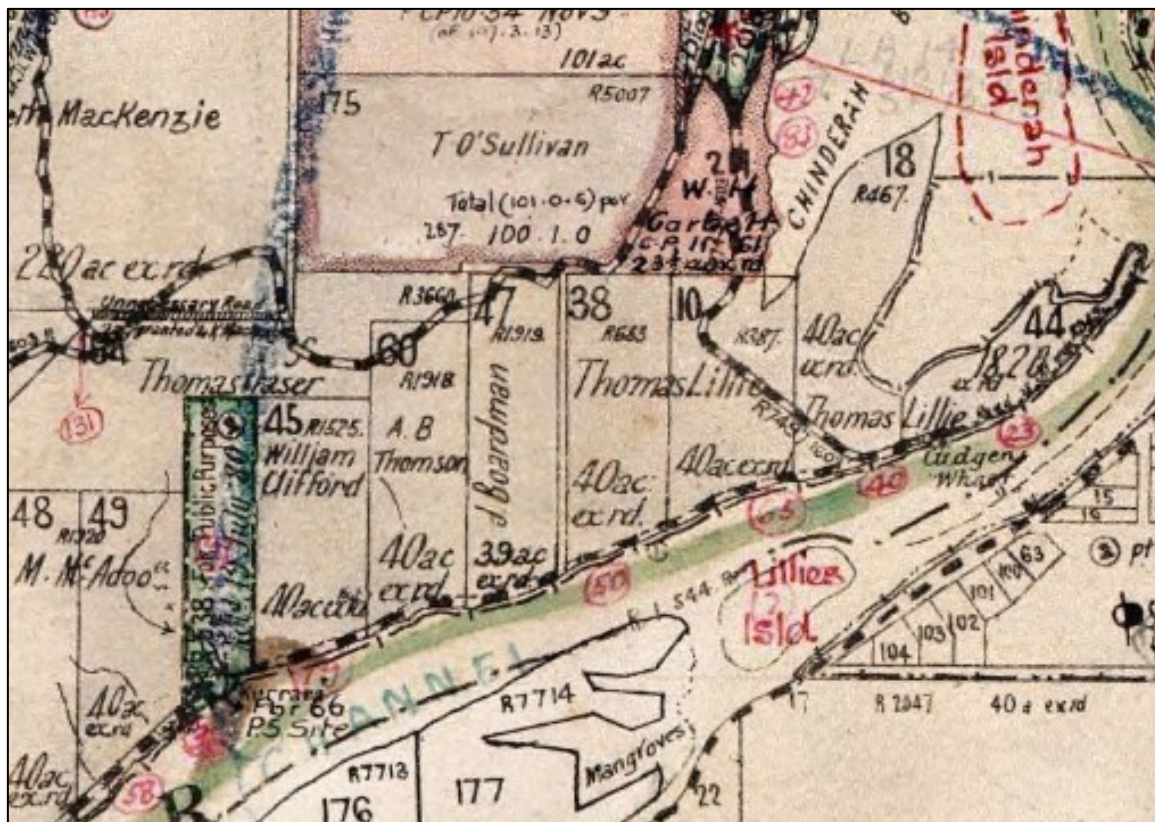


Figure 15 – 1918 Terranora Parish Map Extract (<http://hlrv.nswlrs.com.au/pixel.htm>)

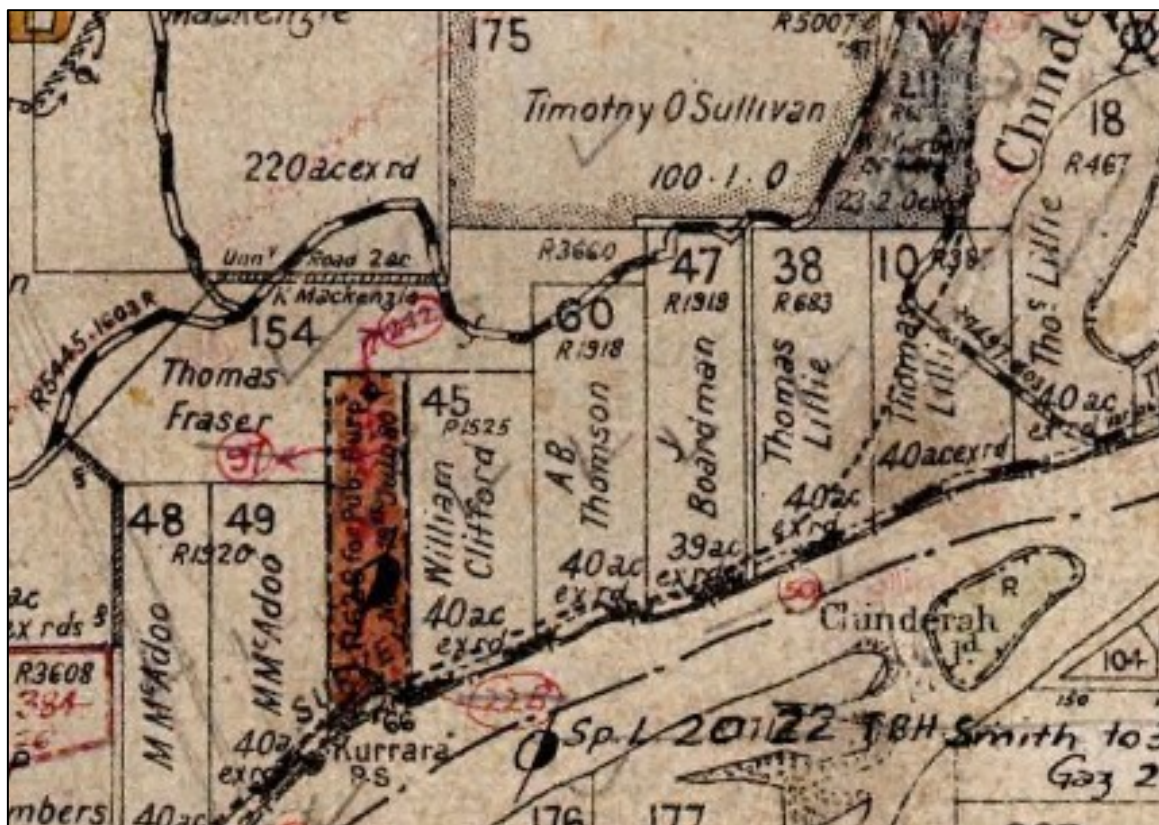


Figure 16 – 1918 Terranora Parish Map Extract (<http://hlrv.nswlrs.com.au/pixel.htm>)

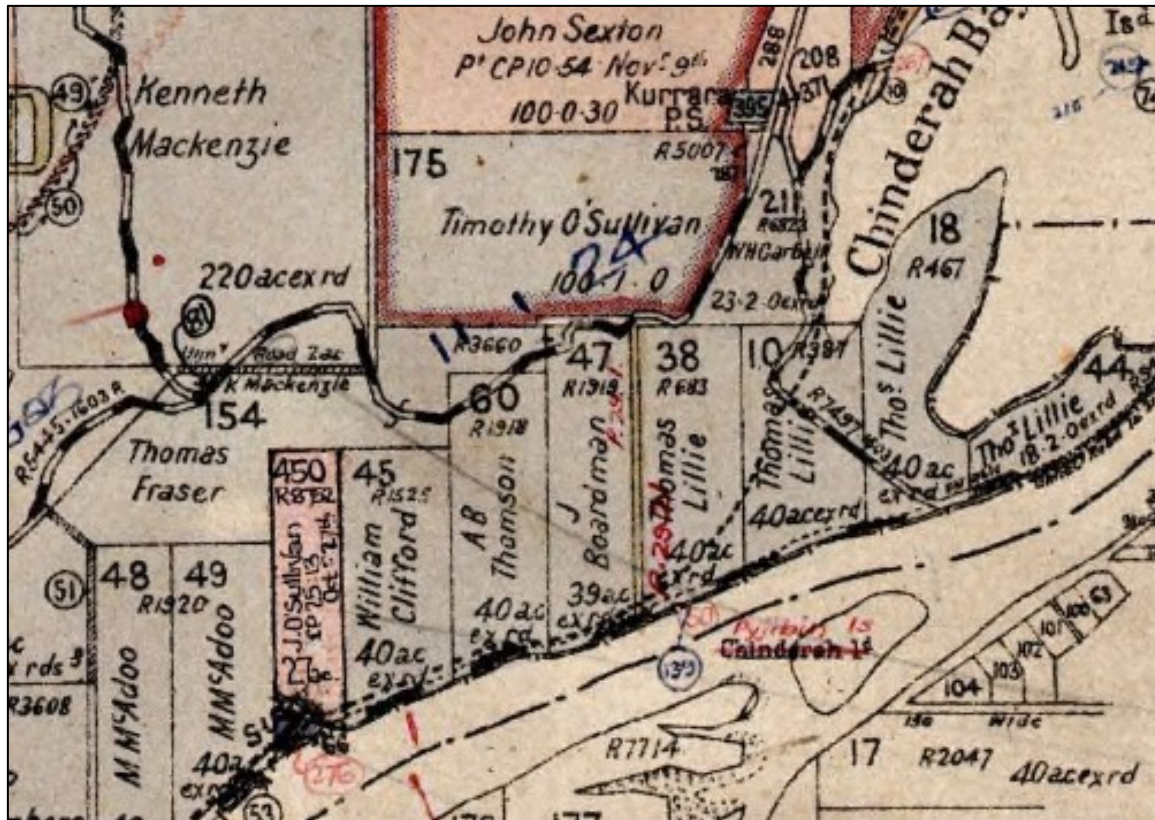


Figure 17 – 1924 Terranora Parish Map Extract (<http://hlrv.nswlrs.com.au/pixel.htm>)

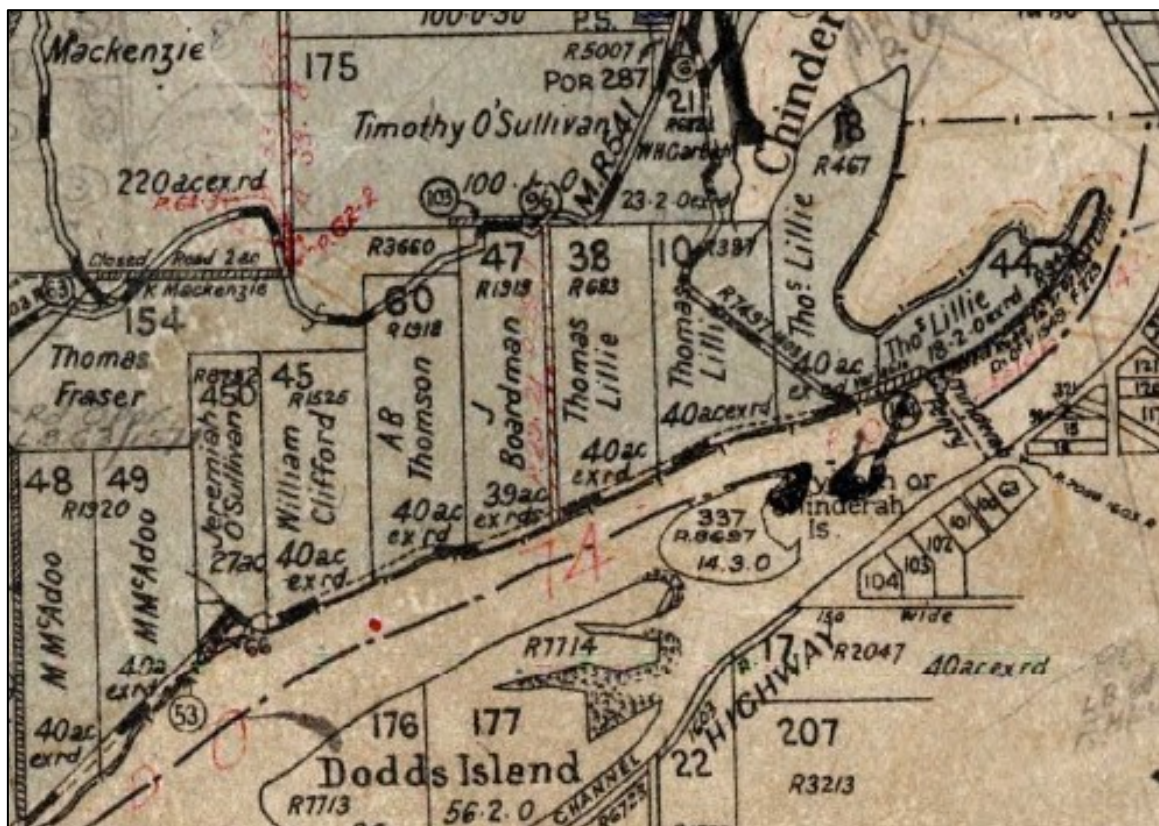


Figure 18 – 1959 Terranora Parish Map Extract (<http://hlrv.nswlrs.com.au/pixel.htm>)



APPENDIX 8 - HISTORIC TOPOGRAPHIC MAPS



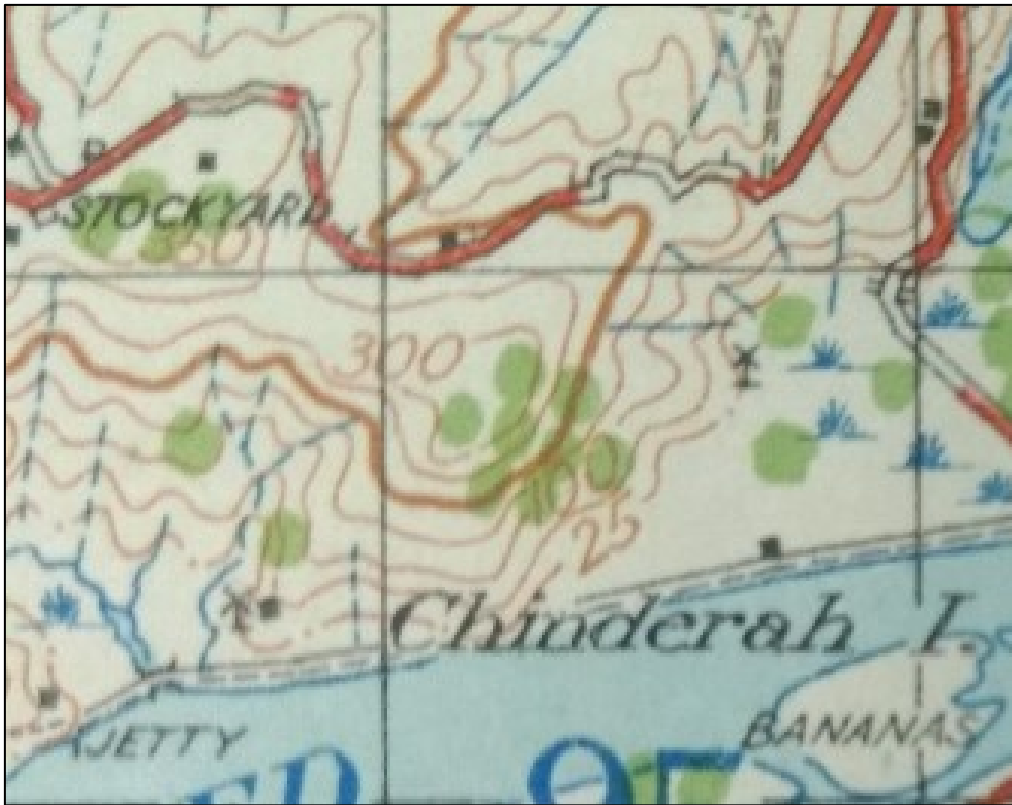


Figure 19 – 1942 *Tweed Heads* Topographical Map extract.

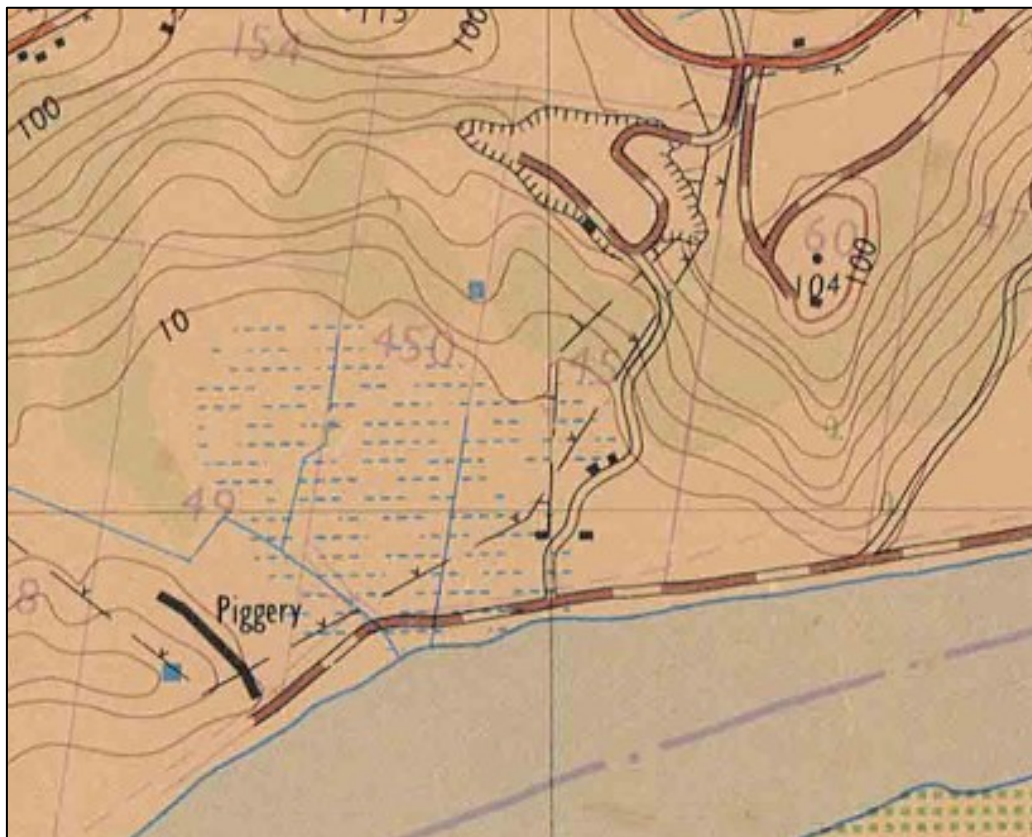


Figure 20 – 1974 *Tweed Heads* Topographical Map extract.

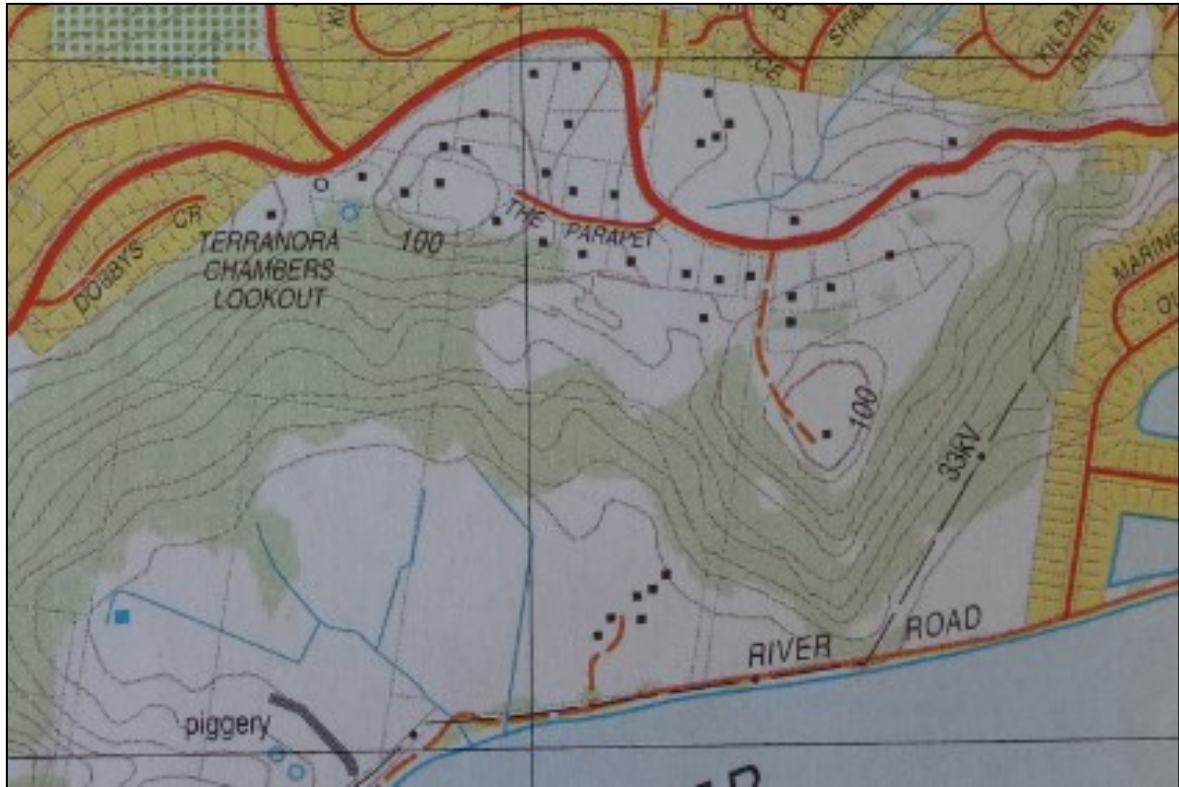


Figure 21 – 2002 *Tweed Heads* Topographical Map extract.

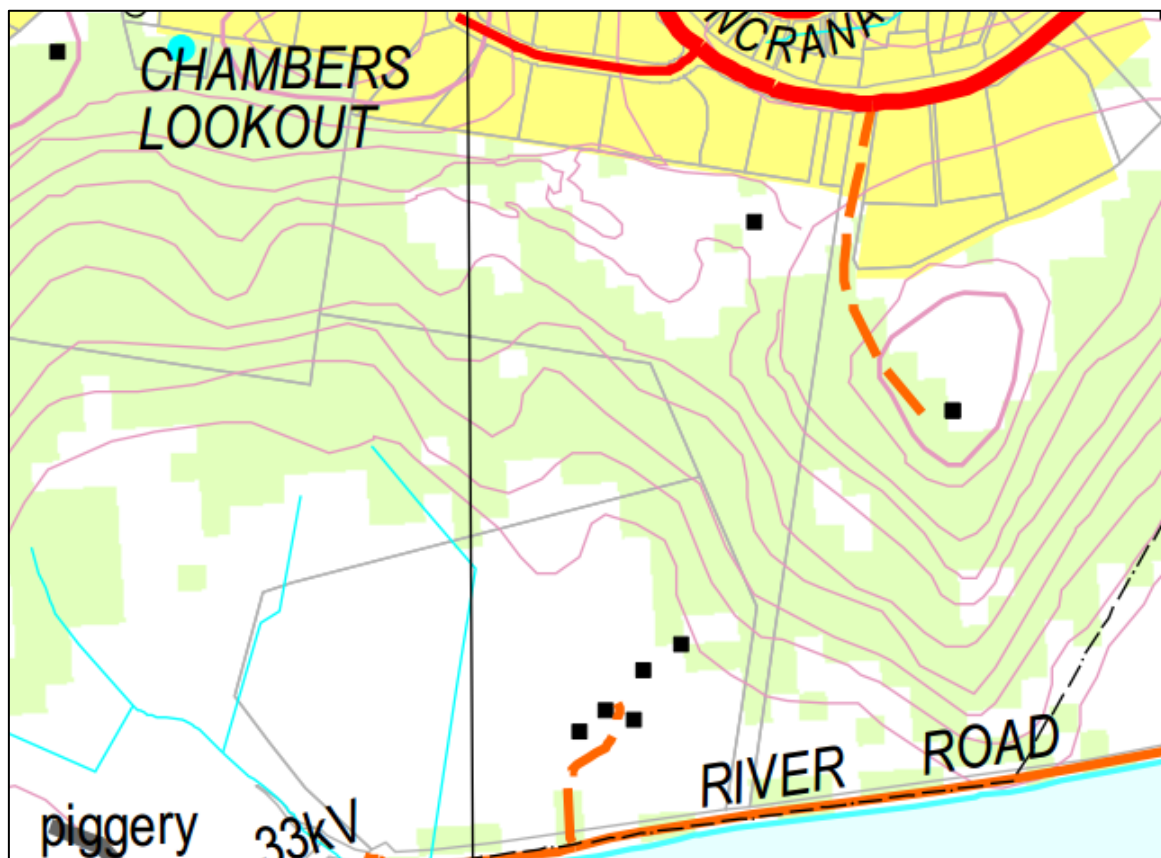


Figure 22 – 2016 *Tweed Heads* Topographical Map extract.

APPENDIX 9 - ZONE MAPPING



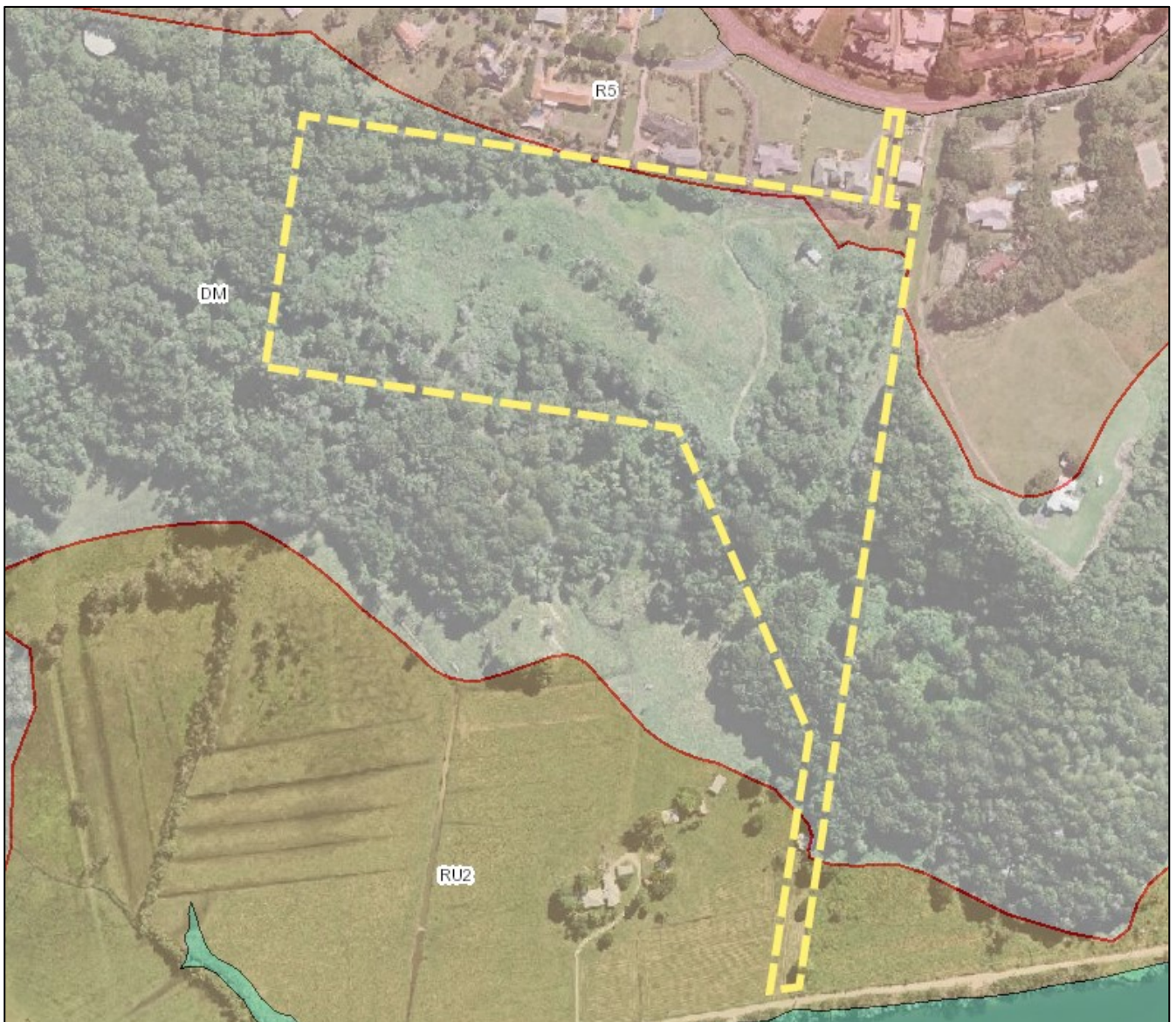


Figure 23 – NSW Legislation Zone Plan

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

APPENDIX 10 - PHOTOGRAPHIC LOG

Photo No. 1	Date
	19.11.2019

Description:

View west downslope across site.



Photo No. 2	Date
	19.11.2019

Description:

View east and upslope across site.







APPENDIX 11 - LABORATORY RESULTS SUMMARY & RPD



Table 15 – Strategic Stockpile Sampling Laboratory Results

Analyte (mg/kg)	TR1A	TR2A	TR3A	TR4A	TR5A	TR6A	TR7A
Metals/Metalloids							
Arsenic	<5	<5	<5	<5	<5	<5	<5
Chromium (total)	8	7	6	6	6	8	7
Copper	9	8	10	5	10	11	8
Nickel	4	5	5	4	4	5	4
Zinc	62	39	63	29	61	88	66
Cadmium	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Lead	10	9	14	<5	13	16	12
Mercury (inorganic)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BTEX							
Benzene	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethyl Benzene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Petroleum Hydrocarbons							
>C10-C16	<50	<50	<50	<50	<50	<50	<50
>C16-C34	<100	<100	<100	<100	<100	<100	<100
>C34-C40	<100	<100	<100	<100	<100	<100	<100
Total >C10-C40	<50	<50	<50	<50	<50	<50	<50
Polyaromatic Hydrocarbons							
Napthalene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo-pyrene	<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

Table 16 – Relative Percentage Difference (RPD%)

Analyte	TR3A	TR6A	Mean	RPD%	TR3A	TR7A	Mean	RPD%
Metals/Metalloids (mg/kg)								
Arsenic	<5	<5	<5	-	<5	<5	<5	-
Chromium (total)	6	8	7	28.6	6	7	6.5	15.4
Copper	10	11	10.5	9.5	10	8	9	22.2
Nickel	5	5	5	-	5	4	4.5	22.2
Zinc	63	88	75.5	33.1	63	66	64.5	4.7
Cadmium	<0.4	<0.4	<0.4	-	<0.4	<0.4	<0.4	-
Lead	14	16	15	13.3	14	12	13	15.4
Mercury (inorganic)	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	-

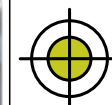
APPENDIX 12 - INVESTIGATION AREA - SAMPLING LOCATIONS PLAN

PRELIMINARY SITE INVESTIGATION

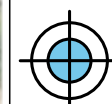
SAMPLING LOCATIONS



HMC Sampling Locations
19_11_2019



Kieran Byrne Sampling
Locations 25_09_2001



Kieran Byrne Sampling
Locations 18_07_2002

Job: HMC2023.305.02
DWG: HMCDWG2023.305
Date: March 2023
Revised: 28/03/2023
Drawn: MF

Lot 16 DP856265
225 Terranora Road
Banora Point NSW



TERRANORA ROAD

TR1A

TR2A

TR3A

TR4A

TR5A

500m² fill material
sampling area
(HMC 19.11.19)
- see inset

#1

Sample 2

Sample 3

#2

Sample 4

#4

Sample 1

#4

#9

#6A

Sample 6

#8

Sample 5

#3

#5

#10

#7

Scale :

0 50 100

APPENDIX 13 - CHAIN OF CUSTODY





CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADRI ADRI 3/1 Buena Road Hobart SA 5005
Ph: 08 8182 5130 E: adelaide@alsglobal.com

BRISBANE 2 Dyth Street Stafford QLD 4053
Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GIL ADISTONE 49 Callamondah Drive Gladstone QD 4680
Ph: 07 4978 7944 E: ALS@enviro Gladstone@alsglobal.com

MACRAT Unit 2/20 Caledonian Drive Paget QD 4740
Ph: 07 4952 5795 E: ALS@enviro Mackay@alsglobal.com

MELBOURNE 2-4 Westall Road Springvale VIC 3171
Ph: 03 8549 9500 E: samples.melbourne@alsglobal.com

MUDGEE 129 Sydney Road Mudgee NSW 2850
Ph: 02 6372 8735 E: mudgee@mail@alsglobal.com

NEWCASTLE 3/100 Morland Road Mayfield West NSW 2304
Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

NOOWRA 4/13 Geary Place North Nowra NSW 2541
Ph: 02 4423 2063 E: nowra@alsglobal.com

PERTH 10 Wood Way Malaga WA 6000
Ph: 08 9209 7655 E: samples.perth@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164
Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Desma Court Bohle QLD 4818
Ph: 07 4795 0600 E: ALS@enviro Townsville@alsglobal.com

WOLLONGONG 1/10-21 Ralph Black Drive, Nth Wollongong NSW 2500
Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: HMC Environmental Consulting Pty Ltd		TURNAROUND REQUIREMENTS : <input checked="" type="checkbox"/> Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)	
OFFICE: Tweed Heads		(Standard TAT may be longer for some tests e.g., Ultra Trace Organics)		Custody Seal Intact? Yes No N/A	
PROJECT: 225 Terranora Road, Terranora		PROJECT NO.:		Free ice / frozen ice bricks present upon receipt? Yes No N/A	
ORDER NUMBER: 2019.232		PURCHASE ORDER NO.:		Random Sample Temperature on Receipt: °C	
PROJECT MANAGER: M Tunks		CONTACT PH: 0755 368863		Other comment:	
SAMPLER: Mark Tunks HMC		SAMPLER MOBILE: 0408 279212		RECEIVED BY: <i>Reade</i>	
COC Emailed to ALS? (YES / NO)		EDD FORMAT (or default):		DATE/TIME: 21.11.19	
Email Reports to (will default to PM if no other addresses are listed): admin@hmcenvironment.com.au		RELINQUISHED BY: <i>[Signature]</i>		DATE/TIME: 12.22	
Email Invoice to (will default to PM if no other addresses are listed): admin@hmcenvironment.com.au		DATE/TIME: 20.11.2019		RECEIVED BY:	

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	P-18/1 COMP NO FMT	P-18/1 DISCRETE	W-7	W-2T			Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1.	TR1A	19.11.2019	S	ST	1	X	X					
2	TR2A	19.11.2019	S	ST	1	X	X					
3.	TR3A	19.11.2019	S	ST	1	X	X					
4.	TR4A	19.11.2019	S	ST	1	X	X					
5.	TR5A	19.11.2019	S	ST	1	X	X					
6.	TR6A	19.11.2019	S	ST	1	X	X					
	TR7A	19.11.2019	S	ST	1	X	X					
7	TRRS1	19.11.2019	W	N, AG, VS	4			X	X			
TOTAL					11	7	7	1	1			

Environmental Division
Brisbane
Work Order Reference
EB1931285



Telephone : +61-7-3243 7222

INTERLAB SPLIT SAMPLE

RINSATE

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; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.

APPENDIX 14 - LABORATORY CERTIFICATES

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.

Signatories	Position	Accreditation Category
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	----	----	----	----
				19-Nov-2019 00:00	----	----	----	----
Client sampling date / time								
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), Dibenzo(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