Terara Shoalhaven Sand
C/- Ernest Panucci

Contamination Assessment: Proposed Expansion of Sand Dredging Operations at Terara Shoalhaven Sand, Pig Island, Terara NSW.

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

CIVIL

PROJECT MANAGEMENT

P1806743JR03V01
April 2019

Copyright Statement

Limitations Statement

The sole purpose of this report and the associated services performed by Martens & Associates Pty Ltd is to provide a Preliminary Site Investigation at the subject site in accordance with the scope of services set out in the contract / quotation between Martens & Associates Pty Ltd and Terara Shoalhaven Sand C/- Ernest Panucci (hereafter known as the Client). That scope of works and services were defined by the requests of the Client, by the time and budgetary constraints imposed by the Client, and by the availability of access to the site.

Martens & Associates Pty Ltd derived the data in this report primarily from a number of sources which included correspondence regarding the proposal, examination of records in the public domain, interviews with individuals with information about the site or the project, and field explorations conducted on the dates indicated. The passage of time, manifestation of latent conditions or impacts of future events may require further examination / exploration of the site and subsequent data analyses, together with a re-evaluation of the findings, observations and conclusions expressed in this report.

In preparing this report, Martens & Associates Pty Ltd may have relied upon and presumed accurate certain information (or absence thereof) relative to the site. Except as otherwise stated in the report, Martens & Associates Pty Ltd has not attempted to verify the accuracy of completeness of any such information (including for example survey data supplied by others).

The findings, observations and conclusions expressed by Martens & Associates Pty Ltd in this report are not, and should not be considered an opinion concerning the completeness and accuracy of information supplied by others. No warranty or guarantee, whether express or implied, is made with respect to the data reported or to the findings, observations and conclusions expressed in this report. Further, such data, findings and conclusions are based solely upon site conditions, information and drawings supplied by the Client *etc*. in existence at the time of the investigation.

This report has been prepared on behalf of and for the exclusive use of the Client, and is subject to and issued in connection with the provisions of the agreement between Martens & Associates Pty Ltd and the Client. Martens & Associates Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report by any third party.

Head Office
Suite 201, 20 George Street
Hornsby, NSW 2077, Australia
ACN 070 240 890 ABN 85 070 240 890
Phone: +61-2-9476-9999
Fax: +61-2-9476-8767
Email: mail@martens.com.au
Web: www.martens.com.au

Document and Distribution Status

Author(s)	Reviewer(s)	Project Manager	Signature
Daniel O'Sullivan	Andrew Norris Brett McLennan	Jeff Fulton	

Revision No.	Status	Release Date	Document Location					
			File Copy	Ernest Panucci	'	'	'	'
1	Draft	19.12.2018	1E, 1P	1P	-	-	-	-
1	Final	29.04.2019	1E, 1P	1P	-	-	-	-

Distribution Types: F = Fax, H = hard copy, P = PDF document, E = Other electronic format. Digits indicate number of document copies.

All enquiries regarding this project are to be directed to the Project Manager.

Contents

Abbreviations

AFFF Screen – Aqueous film forming foam screen

AHD – Australian Height Datum

ANZG – Australia and New Zealand Governments

ANZECC – Australian and New Zealand Environment and Conservation Council

ASC NEPM – Assessment of site contamination (National Environmental Protection Measure)

ARMCANZ – Agriculture and Resource Management Council of Australia and New Zealand

BTEXN – Benzene, toluene, ethylbenzene, xylene, naphthalene

COC – Chain of custody

COPC – Contaminants of potential concern

DP – Deposited Plan

DPE – NSW Department of Planning and Environment

DQI – Data quality indicators

DQO – Data quality objective

EIS – Environment Impact Statement

EPA – NSW Environmental Protection Authority

HEPA – Heads of EPAs Australia and New Zealand

HIL – Health investigation level

HM – Heavy metals

HSL – Health screening level

ISQG – Interim sediment quality guidelines

MA – Martens and Associates Pty Ltd

mBGL – Meters below ground level

NATA – National Association of Testing Authorities

NEPC – National Environment Protection Council

NSW – New South Wales

OCP – Organochloride pesticides

OEH – NSW Office of Environment and Heritage

OPP – Organophosphate pesticides

PFAS – Per and poly-fluoroalkyl substances

QA – Quality assurance

QC – Quality control

RPD – Relative percentage difference – difference between two values divided by the average

SAC – Site acceptance criteria

SAQP – Sampling analytical and quality plan

SEARs – Secretaries Environmental Assessment Requirements

SOP – Standard operating procedure

TRH – Total recoverable hydrocarbons

UCL – Upper confidence limit

1 Overview

1.1 Introduction

This report, prepared by Martens and Associates (MA), documents the findings of a contamination assessment to satisfy the Secretaries Environmental Assessment Requirements (SEARs 1234, Attachment A) outlined by the NSW Department of Planning & Environment (DPE) for the proposed expansion of the current Terara Shoalhaven Sand extraction area at the western point of Pig Island, Terara, NSW ('the site').

1.2 Objectives

To address contamination related matters raised in the Secretary's Environmental Assessment Requirements (SEARs) - Terara Shoalhaven Sand (SEAR 1234), dated 29 July 2018 and to ensure the following guidelines adhered to.

- State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55),
- Agricultural Land Classification (DPI),
- Rural Land Capability Mapping (OEH),
- Soil and Landscape Issues in Environmental Impact Assessment (NOW),
- Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC),
- Guidelines for Consultants Reporting on Contaminated Sites (EPA),
- Agricultural Issues for Extractive Industry Development (DPI).

1.3 Project Scope

Scope of work included:

- Site inspection and consultation with Terara Shoalhaven Sand to determine vibracore investigations locations based on the proposed dredging area.
- Intrusive investigation (vibracore) and sampling program, targeting areas within the proposed dredging area extension.

- Laboratory analyses of selected samples for identified contaminants of potential concern (COPC) and assessment against site acceptance criteria (SAC).

- Preparation of contamination report to support the EIS application in accordance with current guidelines.

1.4 Reference Guidelines

This assessment is prepared in general accordance with the following guidelines:

- ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
- DEC (2017) Guidelines for the NSW Site Auditor Scheme – 3rd edition.
- HEPA (2018) *PFAS National Environmental Management Plan.*
- NEPC (2013) National Environmental Protection (Assessment of Site Contamination) Measure, referred to as the ASC NEPM 2013.
- NSW EPA (2017) 3rd Ed. *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme.*
- NSW EPA (2016) *Designing Sampling Programs for Sites Potentially Contaminated by PFAS.*
- NSW EPA (1998) *Managing Land Contamination: Planning Guidelines, SEPP 55 – Remediation of Land.*
- NSW EPA (2015) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997.*
- NSW OEH (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.*

2 Site Description

2.1 Site Location and Existing Land Use

Site information is summarised in Table 1.

Table 1: Site background information.

Item	Description / Detail
Site address	Pig Island, Nowra, NSW
Legal identifier	Lot 1-4 DP 1184790
Approximate area	Pig Island: 1.16 km^2 (Six Maps, 2018) Sand extraction extension: 0.27 km^2 (JPS, 2018)
Local Government Area	Shoalhaven City Council (Council)
Current zoning	The property is currently zoned RU1 – Primary Production
Site description and proposed use	The existing sand extraction area is located at the western point of Pig Island. The proposal includes the extension of the existing dredging footprint to the east (along the northern edge of Pig Island) to allow extraction of sand via dredging a maximum of 100,000 tonnes of river sand in any year over a 30 year period.
Surrounding land uses	The northern bank of the Shoalhaven River is occupied by industrial properties including Shoalhaven Starches Pty Ltd, Argyle Meat and Venus Shell Systems with rural residential properties and agricultural land. The river bank to the south contains a mixture of residential properties, agricultural land and commercial properties including, Shoalhaven Caravan Village, Terara Shoalhaven Sand Pty Ltd and Terara Riverside Retreat.
Topography	The sand flats for the proposed dredging area are generally flat with site slopes < 2%. The site is located on sand flats in the tidal portion of Shoalhaven River at the western portion of Pig Island. The southeast portion of the proposed dredging area (closest to the western end of Pig Island) has an elevation of 0.19 mAHD, - 0.25 mAHD in the northern, - 1.11 mAHD in the eastern and - 2.7 mAHD in the western portion.
Expected geology	The *Wollongong 1:250,000 Geological Series Sheet S1 56.9 (1966)* describes site geology as alluvium, gravel, swamp deposits and sand dunes. The NSW Environment and Heritage eSPADE website identifies the site as having Shoalhaven soil landscapes consisting of alluvium – gravel, sand, silt and clay derived mainly from sandstone and shale overlying buried estuarine sediments.
Environmental receptors	Shoalhaven River
Sensitive receptors	o Future site visitors and workers. o Residential/rural/commercial site occupants adjacent to Shoalhaven River. o Users of dredged sand material. o Recreational users. o Marine life within Shoalhaven River.

3 Sampling, Analytical and Quality Plan

A SAQP has been developed to ensure that data collected as part of the contamination assessment is representative and provides a robust basis for site assessment decisions. Preparation of the SAQP has been completed in general accordance with ASC NEPM (2013) methodology and includes:

- Data quality objectives.
- Sampling methodologies and procedures.
- Field screening methods.
- Sample handling, preservation and storage procedures.
- Analytical QA/QC.

3.1 Data Quality Objectives

Data quality objectives (DQO) have been prepared as statements specifying qualitative and quantitative data required to support project decisions. DQO have been prepared in general accordance with NSW EPA (2017) and ASC NEPM (2013) guidelines and are presented in Table 2.

Table 2: Data quality objectives for the assessment of soil investigations.

Step 1 **Stating the Problem**	The proposed development will include the expansion of an existing sand dredging operation and may mobilise to the river or expose future sand users to COPC.
Step 2 **Identifying the Decision(s)**	This contamination assessment is required to assess the suitability of the extracted sand material for use on residential properties or other high risk uses in terms of potential contamination of sands. To assess the suitability of the site for future use of site sands, decisions are to be made based on the following questions: o Is site sand quality suitable for residential properties and other high risk uses. o Fauna and flora species in Shoalhaven River. o Recreational uses of waterway. o Has previous or current site use impacted the quality of site sands posing a human health risk during intended future use.
Step 3 **Identification of Inputs to the Decision**	The inputs to the contamination assessment of the site will include: o Soil sampling at nominated locations across the site. o Laboratory analytical results for relevant COPC. o Assessment of analytical results against interim sediment quality guidelines.

Step 4 **Study Boundary Definitions**	Study boundaries are as follows: o Lateral – Lateral boundary of the assessment is defined by the proposed dredging area in Attachment B. o Vertical – Vertical boundary is the maximum depth reached below ground level during vibracoring (3.7 mBGL). o Temporal – At this stage of investigation, only one round of sampling has been undertaken in the proposed dredging area.
Step 5 **Development of Decision Rules**	The decision rule for the proposed sand dredging area is as follows: If the concentration of contaminants in the soil data exceeds the adopted assessment criteria (Table 3); an assessment of the need to further investigate in relation to the proposed sand use will be undertaken.
Step 6 **Specification of Limits on Decision Errors**	Guidance found in ASC NEPM (2013) Schedule B2 regarding 95% upper confidence limit (UCL) states that 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. Therefore, a decision can be made based on a probability that 95% of the data collected will satisfy the site acceptance criteria. A limit on decision error will be 5% that a conclusive statement may be incorrect.
Step 7 **Optimisation of Sampling Design**	Proposed sampling locations shall provide even coverage across the proposed sand dredging area.

3.2 Site Assessment Criteria

The site assessment criteria (SAC) adopted for this contamination assessment have been derived from the following source:

- NEPC (2013) *National Environmental Protection (Assessment of Site Contamination) Measure*.
- ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

Guideline values for individual contaminants analysed for this assessment are presented in laboratory tables in Attachment E.

Table 3 summarises the applicability of the SAC adopted for this investigation.

Table 3: Summary of SAC.

Media	Adopted Guidelines	Applicability
Soil	ASC NEPM (2013) ANZG (2018) Australian and New Zealand Guidelines for Fresh and Marine Water Quality	Health Investigation Levels (HILs) HIL A – residential land use with access to soil Health Screening Levels (HSLs) HSL A – Low density residential land use for coarse soils (ASC NEPM, 2013) has been adopted. Management Limits TRH management levels have been adopted based potential future residential land use of sand material. Interim sediment quality guidelines (ISQG) Recommended sediment quality guidelines using trigger values for ISQG low. PFAS Due to the preliminary nature of the investigation, PFAS will be assessed on a detect/non-detect basis.

3.3 Data Quality Indicators

In general accordance with NSW EPA (2017), the investigation data set has been compared with Data Quality Indicators (DQI) outlined in Table 4 to ensure that collected data meets the project needs and that DQOs have been meet.

Table 4: Data Quality Indicators.

Assessment Measure (DQI)	Comment
Precision – A measure of the variability (or reproducibility) of data.	Precision is assessed by reviewing blind field duplicated sample set through the calculation of relative percent difference (RPD). Data precision is deemed acceptable where concentrations are less than 10 x EQL, or RPDs are less than 50% (10-30 x EQL) or 30% (>30 x EQL). Exceedance of this range is still considered acceptable where heterogeneous materials are sampled.
Accuracy – A measure of the closeness of reported data to the "true value".	Data accuracy is assessed by: o Field spikes and blanks. o Laboratory control samples.

Assessment Measure (DQI)	Comment
Representativeness – The confidence that data are representative of each media present on the site.	To ensure data representativeness the following field and laboratory procedures are followed: o Ensure that the design and implementation of the sampling program has been completed in accordance with MA standard operating procedures (SOP). o Blank samples shall be used during field sampling to ensure no cross contamination or laboratory artefacts. o Ensure that all laboratory hold times are met and that sample handling and transport is completed in accordance with MA SOP.
Completeness – A measure of the amount of usable data from a data collection activity.	To ensure data set completeness, the following is required: o Confirmation that all sampling methodology was completed in general accordance with MA SOP. o COC and receipt forms. o Results from all laboratory QA/QC samples (lab blanks, trip/spike, interlab and intralab duplicates). o NATA accreditation stamp on all laboratory reports.
Comparability - The confidence that data may be considered to be equivalent for each sampling and analytical event.	Data comparability is maintained by ensuring that: o All site sampling events are undertaken following methodologies outlined in MA SOP and published guidelines. o NATA accredited laboratory methodologies shall be followed on all laboratory testing.

3.4 Investigation and Sampling Methodology and Quality Assurance / Quality Control

Site investigation and soil sampling methodology (Table 5) was completed to meet the project DQOs.

Table 5: Investigation and sampling methodology.

Activity	Detail / Comments
Fieldworks	An initial walkover inspection was undertaken 18 September 2018 with subsurface investigations completed on the same day, and involved the excavation of four vibracores down to a depth of 3.7 mBGL. Attachment C shows vibracore testing locations.
Soil and sediment sampling	Contamination sampling was completed by the supervising MA environmental engineer using a nitrile glove covered hand or via direct sampling from the aluminium vibracore casing. Each sample was placed into a laboratory-supplied, 250 mL glass jar, labelled with a unique identification number and no headspace to limit volatile loss. A clean pair of disposable gloves were used when handling each sample.

Activity	Detail / Comments
QA / QC sampling	QA samples were collected as follows: Two soil duplicate samples were collected for intra-laboratory analysis during investigations. One triplicate was collected for inter-laboratory analysis. One trip blank and one trip spike sample were used during sampling.
Sample handling and transportation	Sample collection, storage and transport were conducted according to MA SOP. Collected samples were placed immediately into an ice chilled cooler-box. Samples were dispatched to NATA-accredited laboratories under chain of custody documentation within holding times.

A review of QA/QC procedure has been completed and is presented in the data validation report (Attachment D). The report concludes that data is suitable for the purposes of the assessment.

3.5 Laboratory Analytical Suite

Primary laboratory analysis was carried out by Envirolab Pty Ltd a NATA accredited laboratory. Laboratory analysis is summarised in Table 6.

Table 6: Summary of laboratory analyses.

COPC	Number of Samples Analysed	Sample IDs	
BTEXN	6 samples	6743/VC301/0.1-0.4	6743/VC303/0.9 - 1.3
		6743/VC302A/0.9 - 1.2	6743/VC304A/0.4 - 0.6
		6743/VC302B/0.0 - 0.3	6743/VC304B/3.0 - 3.2
TRH	6 samples	6743/VC301/0.1-0.4	6743/VC303/0.9 - 1.3
		6743/VC302A/0.9 - 1.2	6743/VC304A/0.4 - 0.6
		6743/VC302B/0.0 - 0.3	6743/VC304B/3.0 - 3.2
PAH	6 samples	6743/VC301/0.1-0.4	6743/VC303/0.9 - 1.3
		6743/VC302A/0.9 - 1.2	6743/VC304A/0.4 - 0.6
		6743/VC302B/0.0 - 0.3	6743/VC304B/3.0 - 3.2
Heavy metals[1]	12 samples	6743/VC301/0.1-0.4	6743/VC304A/0.4 - 0.6
	2 duplicates	6743/VC301/2.7-3.0	6743/VC304A/3.2 - 3.4
	1 triplicate	6743/VC302A/0.0 - 0.5	6743/VC304B/0.4 - 0.6
		6743/VC302A/0.9 - 1.2	6743/VC304B/3.0 - 3.2
		6743/VC302B/0.0 - 0.3	Duplicate 1
		6743/VC302B/1.6 - 2.0	Duplicate 2
		6743/VC303/0.5 - 0.8	Triplicate 1
		6743/VC303/0.9 - 1.3	
OCP/OPP	12 samples	6743/VC301/0.1-0.4	6743/VC303/0.5 - 0.8
		6743/VC301/2.7-3.0	6743/VC303/0.9 - 1.3
		6743/VC302A/0.0 - 0.5	6743/VC304A/0.4 - 0.6
		6743/VC302A/0.9 - 1.2	6743/VC304A/3.2 - 3.4
		6743/VC302B/0.0 - 0.3	6743/VC304B/0.4 - 0.6
		6743/VC302B/1.6 - 2.0	6743/VC304B/3.0 - 3.2

COPC	Number of Samples Analysed	Sample IDs	
AFFF screen (PFAS)	6 samples	6743/VC301/0.1-0.4 6743/VC302A/0.9 - 1.2 6743/VC302B/0.0 - 0.3	6743/VC303/0.9 - 1.3 6743/VC304A/0.4 - 0.6 6743/VC304B/3.0 - 3.2

Notes:

[1] Heavy metals – arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc.

4 Results

4.1 Laboratory Analytical Results

The following sections summarise the results of laboratory analysis for all samples. Detailed tabulated results showing individual sample concentrations compared to adopted SAC are available in Attachment E. Laboratory analytical documentation is available in Attachment F.

4.1.1 Sample Analytical Results

Sampling was undertaken for each vibracore casing collected on the site. Results of the samples tested are presented in Table 7.

Table 7: Summary of sediment laboratory results.

Analyte	Results Compared to SAC
Heavy Metals	ISQG - Low The ISQC - low for nickel (21 mg/kg) was exceeded at sample location **6743/VC304A/3.2 - 3.4 (34 mg/kg).** HILs All results below SAC.
TRH/BTEXN	ISQG - Low All results below SAC. HILs All results below SAC. HSLs All results below SAC. Management Limits All results below SAC.
OCP/OPP	ISQG - Low All results below SAC. HILs All results below SAC. EIL All results below SAC.
PAH	ISQG - Low All results below SAC. HILs All results below SAC. HSLs All results below SAC.
AFFF screen (PFAS)	PFAS was less than the laboratory detection limits in all sediment samples tested.

4.1.2 95% Upper Confidence Limit Calculations

A 95% UCL for nickel was calculated using the 11 discrete soil samples closest to the VC304A hotspot, which provided a value of 17 mg/kg, which is below the adopted ISQG for nickel (21mg/kg) and is not a threat to potential riverine health. Refer to Attachment F for the 95% UCL spreadsheet.

4.1.3 Quality Assurance and Quality Controls

RPD control limits have not been exceeded in either duplicate or triplicate sample. Refer to Attachment D for the data validation report.

5 Discussion and conclusion

Soil sample 6743/VC304A/3.2 - 3.4 (34 mg/kg) exceeded the adopted ISQG - Low for nickel (21 mg/kg). 95% UCL calculation for the data was 17 mg/kg using the closest 11 discreet samples across the proposed sand dredging area. As this is below the adopted SAC (and also well below the HIL of 400 mg/kg), no further investigation is required with regards to nickel contamination.

All contaminant concentrations are regarded to be less than the SAC. This included PFAS, which was identified flagged by Health NSW as a potential contaminant of concern, due to recent detection in the Shoalhaven River.

The site contamination assessment completed provides sufficient information to satisfy NSW EPA that, as required by Clause 7 of SEPP 55:

- *1 (a) – it has considered whether the land is contaminated* – it is concluded that the dredged material will not have any impacts on environmental or human health.

- *1(b) – if the land is contaminated, it is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out,* - the nature of the identified site contamination is such that no further remediation is required and the site is rendered fit for the intended use.

All laboratory tested samples had analyte concentrations below SAC with the exception of one sample that exceeded the SAC for nickel; however, this is not considered a threat due to the results of the UCL calculation.

In addressing the SEARs requirements regarding land contamination, MA considers that the site material is suitable for use on residential properties or other high risk uses, and no risk to human health or environment from the material was identified in the investigation.

6 Limitations Statement

This contamination assessment was undertaken in line with current industry standards.

It is important, however, to note that no land contamination study can be considered to be a complete and exhaustive characterisation of a site nor can it be guaranteed that any assessment shall identify and characterise all areas of potential contamination or all past potentially contaminating land-uses. Therefore, this report should not be read as a guarantee that no contamination shall be found on the site. Should material be exposed in future which appears to be contaminated or inconsistent with natural site soils, additional testing may be required to determine the implications for the site.

Martens & Associates Pty Ltd has undertaken this assessment for the purposes of the current development proposal. No reliance on this report should be made for any other investigation or proposal. Martens & Associates Pty Ltd accepts no responsibility, and provides no guarantee regarding the characteristics of areas of the site not specifically studied in this investigation.

7 References

ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

Johnson Procter Surveyors, Survey, 2018.

NEPC (2013) *National Environmental Protection (Assessment of Site Contamination) Measure* – Referred to as ASC NEPM (2013).

NSW EPA (2017) 3rd Ed. *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme*.

NSW Department of Environment & Heritage (eSPADE, NSW soil and land information), www.environment.nsw.gov.au.

NSW EPA (1998) *Managing Land Contamination: Planning Guidelines, SEPP 55 – Remediation of Land.*

NSW OEH (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites, 2nd Edition*.

NSW EPA (2015) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*.

Rose G. (1966) Wollongong 1:250 000 Geological Sheet SI/56-09, 2nd edition, Geological Survey of New South Wales, Sydney.

Secretary's Environmental Assessment Requirements (SEARs) - Terara Shoalhaven Sand (SEAR 1234), dated 29 July 2018

State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55)

8 Attachment A – Secretaries Environmental Assessment Requirements and NSW Government Correspondence

Natural Resources Access Regulator

Rob Beckett
Environmental Assessment Officer
Resource Assessments
GPO Box 39
Sydney NSW 2001

via email: rob.beckett@planning.nsw.gov.au

Our ref V18/314#40 & OUT18/8776

Dear Mr Beckett,

Re: Secretary's Environmental Assessment Requirements (SEARs ID No. 1234) – Project Extension to Terara Shoalhaven Sand Quarry, Shoalhaven LGA.

Thank you for your email of 28 May 2018 seeking the Natural Resources Access Regulator's (NRAR) comments on the SEARs request for the above designated development proposal. NRAR has reviewed the supporting documentation accompanying the request for SEARs and provides the following comments below, and further detail in **Attachment A.**

NRAR requires the following information to be included in the EIS:

- An assessment of impacts to surface and groundwater sources including water use, water licensing arrangements, impacts on water users, waterfront land and aquifers, as well as compliance with relevant policies.

- Detail of any groundwater dewatering which may be required during the construction phase of the project. This discussion should include:
    - information on the sites hydrogeology;
    - a description of the current groundwater situation, such as groundwater quality and groundwater level;
    - predicted groundwater take, inclusive of the calculations supporting this estimate; and
    - a discussion on impacts in line with the Aquifer Interference Policy (2012).

Please contact Ryan Shepherd, Water Regulation Officer (Newcastle) on (02) 4904 2650 or ryan.shepherd@dpi.nsw.gov.au if you have further enquiries regarding this matter.

Yours sincerely

Marcus Leslie
A/Manager, Regional Water Regulation (East)
Natural Resources Access Regulator
Department of Industry – Lands and Water

7/6/2018

NRAR General Assessment Requirements for general projects

The following detailed assessment requirements are provided to assist in adequately addressing the assessment requirements for this proposal.

For further information visit the Lands and Water website, www.water.nsw.gov.au

Key Relevant Legislative Instruments

This section provides a basic summary to aid proponents in the development of an Environmental Impact Statement (EIS), and should not be considered a complete list or comprehensive summary of relevant legislative instruments that may apply to the regulation of water resources for a project.

The EIS should take into account the objects and regulatory requirements of the *Water Act 1912* (WA 1912) and *Water Management Act 2000* (WM Act), and associated regulations and instruments, as applicable.

*Water Management Act 2000 (*WM Act*)*
Key points:

- Volumetric licensing in areas covered by water sharing plans
- Works within 40m of waterfront land
- SSD & SSI projects are exempt from requiring water supply work approvals and controlled activity approvals as a result of the *Environmental Planning & Assessment Act 1979 (EP&A Act)*.
- No exemptions for volumetric licensing apply as a result of the *EP&A Act*.
- Basic landholder rights, including harvestable rights dams
- Aquifer interference activity approval and flood management work approval provisions have not yet commenced and are regulated by the *Water Act 1912*
- Maximum penalties of $ 2.2 million plus $ 264,000 for each day an offence continues apply under the WM Act
- Flood management works

Water Act 1912 (WA 1912)
Key points:

- Volumetric licensing in areas where no water sharing plan applies
- Monitoring bores
- Aquifer interference activities that are not regulated as a water supply work under the WM Act.
- No exemptions apply to licences or permits under the *WA 1912* as a result of the *EP&A Act*.
- Regulation of water bore driller licensing.

Water Management (General) Regulation 2011
Key points:

- Provides various exemptions for volumetric licensing and activity approvals
- Provides further detail on requirements for dealings and applications.

Access Licence Dealing Principles Order 2004

Harvestable Rights Orders

Water Sharing Plans these are considered regulations under the WM Act

It is important that the proponent understands and describes the ground and surface water sharing plans, water sources, and management zones that apply to the project. The relevant water sharing plans can be determined spatially at www.ourwater.nsw.gov.au. Multiple water sharing plans may apply and these must all be described.

The *Water Act 1912* applies to all water sources not yet covered by a commenced water sharing plan.

The EIS is required to:

- Demonstrate how the proposal is consistent with the relevant rules of the Water Sharing Plan including rules for access licences, distance restrictions for water supply works and rules for the management of local impacts in respect of surface water and groundwater sources, ecosystem protection (including groundwater dependent ecosystems), water quality and surface-groundwater connectivity.
- Provide a description of any site water use (amount of water to be taken from each water source) and management including all sediment dams, clear water diversion structures with detail on the location, design specifications and storage capacities for all the existing and proposed water management structures.
- Provide an analysis of the proposed water supply arrangements against the rules for access licences and other applicable requirements of any relevant WSP, including:
    - Sufficient market depth to acquire the necessary entitlements for each water source.
    - Ability to carry out a "dealing" to transfer the water to relevant location under the rules of the WSP.
    - Daily and long-term access rules.
    - Account management and carryover provisions.
- Provide a detailed and consolidated site water balance.
- Further detail on licensing requirements is provided below.

Relevant Policies and Guidelines

The EIS should take into account the following policies (as applicable):

- NSW Guidelines for Controlled Activities on Waterfront Land (NOW, 2012)
- NSW Aquifer Interference Policy (NOW, 2012)
- Risk Assessment Guidelines for Groundwater Dependent Ecosystems (NOW, 2012)
- Australian Groundwater Modelling Guidelines (NWC, 2012)
- NSW State Rivers and Estuary Policy (1993)
- NSW Wetlands Policy (2010)
- NSW State Groundwater Policy Framework Document (1997)
- NSW State Groundwater Quality Protection Policy (1998)
- NSW State Groundwater Dependent Ecosystems Policy (2002)
- NSW Water Extraction Monitoring Policy (2007)

DPI Water policies can be accessed at the following links:
http://www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/default.aspx
http://www.water.nsw.gov.au/Water-licensing/Approvals/Controlled-activities/default.aspx

An assessment framework for the NSW Aquifer Interference Policy can be found online at: http://www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/Aquifer-interference.

Licensing Considerations

The EIS is required to provide:

- Identification of water requirements for the life of the project in terms of both volume and timing (including predictions of potential ongoing groundwater take following the cessation of operations at the site – such as evaporative loss from open voids or inflows).
- Details of the water supply source(s) for the proposal including any proposed surface water and groundwater extraction from each water source as defined in the relevant Water Sharing Plan/s and all water supply works to take water.
- Explanation of how the required water entitlements will be obtained (i.e. through a new or existing licence/s, trading on the water market, controlled allocations etc.).
- Information on the purpose, location, construction and expected annual extraction volumes including details on all existing and proposed water supply works which take surface water, (pumps, dams, diversions, etc).
- Details on all bores and excavations for the purpose of investigation, extraction, dewatering, testing and monitoring. All predicted groundwater take must be accounted for through adequate licensing.
- Details on existing dams/storages (including the date of construction, location, purpose, size and capacity) and any proposal to change the purpose of existing dams/storages
- Details on the location, purpose, size and capacity of any new proposed dams/storages.
- Applicability of any exemptions under the *Water Management (General) Regulation 2011* to the project.

Water allocation account management rules, total daily extraction limits and rules governing environmental protection and access licence dealings also need to be considered.

The Harvestable Right gives landholders the right to capture and use for any purpose 10 % of the average annual runoff from their property if in the Eastern or Central Divisions. The Harvestable Right has been defined in terms of an equivalent dam capacity called the Maximum Harvestable Right Dam Capacity (MHRDC). The MHRDC is determined by the area of the property (in hectares) and a site-specific run-off factor. The MHRDC includes the capacity of all existing dams on the property that do not have a current water licence. Storages capturing up to the harvestable right capacity are not required to be licensed but any capacity of the total of all storages/dams on the property greater than the MHRDC may require a licence.

For more information on Harvestable Right dams, including a calculator, visit: http://www.water.nsw.gov.au/Water-licensing/Basic-water-rights/Harvesting-runoff/Harvesting-runoff

Dam Safety

Where new or modified dams are proposed, or where new development will occur below an existing dam, the NSW Dams Safety Committee should be consulted in relation to any safety issues that may arise. Conditions of approval may be recommended to ensure safety in relation to any new or existing dams.

See www.damsafety.nsw.gov.au for further information.

Surface Water Assessment

The predictive assessment of the impact of the proposed project on surface water sources should include the following:

- Identification of all surface water features including watercourses, wetlands and floodplains transected by or adjacent to the proposed project.
- Identification of all surface water sources as described by the relevant water sharing plan.
- Detailed description of dependent ecosystems and existing surface water users within the area, including basic landholder rights to water and adjacent/downstream licensed water users.
- Description of all works and surface infrastructure that will intercept, store, convey, or otherwise interact with surface water resources.
- Assessment of predicted impacts on the following:
    - flow of surface water, sediment movement, channel stability, and hydraulic regime,
    - water quality,
    - flood regime,
    - dependent ecosystems,
    - existing surface water users, and
    - planned environmental water and water sharing arrangements prescribed in the relevant water sharing plans.

Groundwater Assessment

To ensure the sustainable and integrated management of groundwater sources, the EIS needs to include adequate details to assess the impact of the project on all groundwater sources.

Where it is considered unlikely that groundwater will be intercepted or impacted (for example by infiltration), a brief site assessment and justification for the minimal impacts may be sufficient, accompanied by suitable contingency measures in place in the event that groundwater is intercepted, and appropriate measures to ensure that groundwater is not contaminated.

Where groundwater is expected to be intercepted or impacted, the following requirements should be used to assist the groundwater assessment for the proposal.

- The known or predicted highest groundwater table at the site.
- Works likely to intercept, connect with or infiltrate the groundwater sources.
- Any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes.
- Bore construction information is to be supplied to DPI Water by submitting a “Form A” template. DPI Water will supply “GW” registration numbers (and licence/approval numbers if required) which must be used as consistent and unique bore identifiers for all future reporting.
- A description of the watertable and groundwater pressure configuration, flow directions and rates and physical and chemical characteristics of the groundwater source (including connectivity with other groundwater and surface water sources).

- Sufficient baseline monitoring for groundwater quantity and quality for all aquifers and GDEs to establish a baseline incorporating typical temporal and spatial variations.
- The predicted impacts of any final landform on the groundwater regime.
- The existing groundwater users within the area (including the environment), any potential impacts on these users and safeguard measures to mitigate impacts.
- An assessment of groundwater quality, its beneficial use classification and prediction of any impacts on groundwater quality.
- An assessment of the potential for groundwater contamination (considering both the impacts of the proposal on groundwater contamination and the impacts of contamination on the proposal).
- Measures proposed to protect groundwater quality, both in the short and long term.
- Measures for preventing groundwater pollution so that remediation is not required.
- Protective measures for any groundwater dependent ecosystems (GDEs).
- Proposed methods of the disposal of waste water and approval from the relevant authority.
- The results of any models or predictive tools used.

Where potential impact/s are identified the assessment will need to identify limits to the level of impact and contingency measures that would remediate, reduce or manage potential impacts to the existing groundwater resource and any dependent groundwater environment or water users, including information on:

- Any proposed monitoring programs, including water levels and quality data.
- Reporting procedures for any monitoring program including mechanism for transfer of information.
- An assessment of any groundwater source/aquifer that may be sterilised from future use as a water supply as a consequence of the proposal.
- Identification of any nominal thresholds as to the level of impact beyond which remedial measures or contingency plans would be initiated (this may entail water level triggers or a beneficial use category).
- Description of the remedial measures or contingency plans proposed.
- Any funding assurances covering the anticipated post development maintenance cost, for example on-going groundwater monitoring for the nominated period.

Groundwater Dependent Ecosystems

The EIS must consider the potential impacts on any Groundwater Dependent Ecosystems (GDEs) at the site and in the vicinity of the site and:

- Identify any potential impacts on GDEs as a result of the proposal including:
  - the effect of the proposal on the recharge to groundwater systems;
  - the potential to adversely affect the water quality of the underlying groundwater system and adjoining groundwater systems in hydraulic connections; and
  - the effect on the function of GDEs (habitat, groundwater levels, connectivity).
- Provide safeguard measures for any GDEs.

Watercourses, Wetlands and Riparian Land

The EIS should address the potential impacts of the project on all watercourses likely to be affected by the project, existing riparian vegetation and the rehabilitation of riparian land. It is

recommended the EIS provides details on all watercourses potentially affected by the proposal, including:

- Scaled plans showing the location of:
  - wetlands/swamps, watercourses and top of bank;
  - riparian corridor widths to be established along the creeks;
  - existing riparian vegetation surrounding the watercourses (identify any areas to be protected and any riparian vegetation proposed to be removed);
  - the site boundary, the footprint of the proposal in relation to the watercourses and riparian areas; and
  - proposed location of any asset protection zones.
- Photographs of the watercourses/wetlands and a map showing the point from which the photos were taken.
- A detailed description of all potential impacts on the watercourses/riparian land.
- A detailed description of all potential impacts on the wetlands, including potential impacts to the wetlands hydrologic regime; groundwater recharge; habitat and any species that depend on the wetlands.
- A description of the design features and measures to be incorporated to mitigate potential impacts.
- Geomorphic and hydrological assessment of water courses including details of stream order (Strahler System), river style and energy regimes both in channel and on adjacent floodplains.

Landform rehabilitation

Where significant modification to landform is proposed, the EIS must include:

- Justification of the proposed final landform with regard to its impact on local and regional surface and groundwater systems;
- A detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape;
- Outline of proposed construction and restoration of topography and surface drainage features if affected by the project; and
- An outline of the measures to be put in place to ensure that sufficient resources are available to implement the proposed rehabilitation.

Consultation and general enquiries

General licensing enquiries can be made to Advisory Services: water.enquiries@dpi.nsw.gov.au, 1800 353 104.

Assessment or state significant development enquiries, or requests for review or consultation should be directed to the Water Regulation Coordination Unit, water.referrals@dpi.nsw.gov.au.

A consultation guideline and further information is available online at: www.water.nsw.gov.au/water-management/law-and-policy/planning-and-assessment

End Attachment A

Planning & Environment
Resources & Geoscience

7th June 2018

Rob Beckett
Environmental Assessment Officer – Resource Assessments
Department of Planning & Environment
GPO Box 39
Sydney NSW 2001

Emailed: Rob.Beckett@planning.nsw.gov.au

Your Reference: EAR ID No.1234
Our Reference: DOC18/368279

Dear Mr Beckett,

Re: Request for Secretary's Environmental Assessment Requirements - Terara Shoalhaven Sand Quarry - EAR ID No.1234

Thank you for the opportunity to provide advice on the subject proposal. This is a response from NSW Department of Planning & Environment – Division of Resources & Geoscience, Geological Survey of New South Wales (GSNSW).

The building and construction industries in NSW require the ongoing replacement of supplies as current sources are exhausted. The continued sustainable development of existing and new quarries will facilitate the ongoing supply of construction materials to support affordable housing and infrastructure development for the growth of NSW. The resource in the subject area represents a regionally important source of coarse sand for the Shoalhaven region.

It is in the best interests of both the proponent and the community to fully assess the resources which are to be extracted. This means that a thorough geological assessment should be undertaken to determine the nature, quality and extent of the resource. Failure to undertake such an assessment could lead to operational problems and possibly even failure of the proposal.

Construction sand is not a prescribed mineral under the *Mining Act 1992*. Therefore, the Division has no statutory role in authorising or regulating the extraction of this commodity, apart from its role under the *Work Health and Safety Act 2011* and associated regulations and the *Work Health and Safety (Mine and Petroleum Sites) Act 2013* and associated regulations, for ensuring the safe operation of mines and quarries. However, the Division is the principal government authority responsible for assessing the State's resources of construction materials and for advising State and local government on their planning and management.

All environmental reports (EIS or similar) accompanying Development Applications for extractive industry lodged under the *Environmental Planning & Assessment Act 1979* should include a resource assessment **(as detailed in Attachment A)** which:

- **Documents the size and quality of the resource and demonstrates that both have been adequately assessed; and**

- **Documents the methods used to assess the resource and its suitability for the intended applications.**

The above information should be summarised in the EIS, with full documentation appended. If deemed commercial-in-confidence, the resource assessment summary included in the EIS should commit to providing DRG with full resource assessment documentation separately. Applications to modify, expand, extend or intensify an existing consent that has already been adequately reported using the above protocol in publicly available documents, may restrict detailed documentation to the additional resources to be used, if accompanied by a summary of past resource assessments and of past production.

DRG collects data on the quantity of construction materials produced annually throughout the State. Forms are sent to all operating quarries at the end of each financial year for this purpose. The statistical data collected is of great value to Government and industry in planning and resource management, particularly as a basis for analysing trends in production and for estimating future demand for particular commodities or in particular regions. Production data may be published in aggregated form, however production data for individual operations is kept strictly confidential.

In order to assist in the collection of construction material production data, the proponent should be required to provide annual production data for the subject site to the NSW Division of Resources and Geoscience as a condition of any new or amended development consent.

DRG request to be consulted in relation to the proposed location of any biodiversity offset areas (both on and off site) or any supplementary biodiversity measures to ensure there are no consequent reduction in access to prospective land for mineral exploration, or potential for sterilisation of mineral or extractive resources.

Queries regarding the above information, and future requests for advice in relation to this matter, should be directed to the Division of Resources & Geoscience - Land Use team at landuse.minerals@industry.nsw.gov.au.

Yours sincerely

Cressida Gilmore
Manager - Land Use

Encl. Attachments "A"

ATTACHMENT A

NSW Department of Planning & Environment
RESOURCES & GEOSCIENCE DIVISION

ENVIRONMENTAL and WORK HEALTH & SAFETY ASSESSMENT REQUIREMENTS FOR CONSTRUCTION MATERIAL QUARRY PROPOSALS

It is in the best interests of both the proponent and the community to fully assess the resources which are to be extracted. This means that a thorough geological assessment should be undertaken to determine the nature, quality and extent of the resource. Failure to undertake such an assessment could lead to operational problems and possibly even failure of the proposal.

The following issues need to be addressed when preparing an environmental assessment (EA) or environmental impact statement (EIS) for a proposed construction materials (extractive materials) quarry:

Resource Assessment

1. A summary of the regional and local geology including information on the stratigraphic unit or units within which the resource is located.

2. The amount of material to be extracted and the method or methods used to determine the size of the resource (e.g. drilling, trenching, geophysical methods). Plans and cross-sections summarising this data, at a standard scale, showing location of drillholes and/or trenches, and the area proposed for extraction, should be included in the EA or EIS. Relevant supporting documentation such as drill logs should be included or appended. Major resource proposals should be subject to extensive drilling programs to identify the nature and extent of the resource.

3. Characteristics of the material or materials to be produced:
   a) For structural clay/shale extraction proposals, ceramic properties such as plasticity, drying characteristics (e.g. dry green strength, linear drying shrinkage), and firing characteristics (e.g. shrinkage, water absorption, fired colour) should be described.
   b) For sand extraction proposals, properties such as composition, grainsize, grading, clay content and contaminants should be indicated. The inclusion of indicative grading curves for all anticipated products as well as the overall deposit is recommended.
   c) For hard rock aggregate proposals, information should be provided on properties such as grainsize and mineralogy, nature and extent of weathering or alteration, and amount and type of deleterious minerals, if any.
   d) For other proposals, properties relevant to the range of intended uses for the particular material should be indicated.

Details of tests carried out to determine the characteristics of the material should be included or appended. Such tests should be undertaken by NATA registered testing laboratories.

4. An assessment of the quality of the material and its suitability for the anticipated range of applications should be given.

5. The amount of material anticipated to be produced annually should be indicated. If the proposal includes a staged extraction sequence, details of the staging sequence needs to be provided. The intended life of the operation should be indicated.

6. If the proposal is an extension to an existing operation, details of history and past production should be provided.

7. An assessment of alternative sources to the proposal and the availability of these sources. The impact of not proceeding with the proposal should be addressed.

8. Justification for the proposal in terms of the local and, if appropriate, the regional context.

9. Information on the location and size of markets to be supplied from the site.

10. Route(s) used to transport quarry products to market.

11. Disposal of waste products and the location and size of stockpiles.

12. Assessment of noise, vibration, dust and visual impacts, and proposed measures to minimise these impacts.

13. Proposed rehabilitation procedures during, and after completion of, extraction operations, and proposed final use of site.

14. Assessment of the ecological sustainability of the proposal.

Health and Safety Issues

In relation to the health and safety of mining and quarrying operations, the following must be addressed:

1. All mining operations are to comply with the following legislation:
    a. *Work Health and Safety Act 2011*
    b. *Work Health and Safety Regulation 2017*
    c. *Work Health and Safety (Mine and Petroleum Sites) Act 2013*
    d. *Work Health and Safety (Mine and Petroleum Sites) Regulation 2014*
    e. *Explosives Act 2003*
    f. *Explosives Regulation 2013*.

2 The mine holder must appoint a mine operator and notify the Department in writing as required by clause 7 of the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014* before commencing any mining operations.

3. Other duties and notification and reporting requirements exist under the WHS laws and duty holders must ensure they understand and comply with these requirements.

Mineral Ownership

The *Mining Act 1992* applies to those commodities prescribed by the regulations of the Act (Schedule 2, *Mining Regulation 2016*). Most construction materials are not prescribed minerals under the *Mining Act 1992*. In general terms, this means these materials are owned by the Crown where they occur on Crown land and by the landowner in the case of freehold land. A Mining Title is not required for their extraction although a Crown Lands licence is required where they occur on Crown land.

Construction materials such as s*and (other than marine aggregate), loam, river gravel, and coarse aggregate materials such as basalt, sandstone, and granite* are not prescribed minerals under the *Mining Act 1992*. Therefore, the Division of Resources & Geoscience has no statutory responsibility for authorising or regulating the extraction of these commodities, apart from its role under the WHS laws with respect to the safe operation of mines and quarries. However, the Division is the principal government authority responsible for assessing the State's resources of construction materials and for advising State and local government on their planning and management.

Some commodities, notably *structural clay (ie clay for brick, tile and pipe manufacture), dimension stone (except for sandstone), quartzite, kaolin, limestone and marine aggregate* are prescribed minerals under the *Mining Act 1992*. Minerals which are prescribed as minerals under the terms of the Mining Act may, in some cases belong either to the Crown or to an individual, depending on a number of factors including the date on which the mineral was proclaimed and the date of alienation of the land.

The proponent needs to determine whether the material is privately owned or Crown mineral (publicly owned). If it is privately owned, then either a mining lease or mining (mineral owner) lease would be required. If it is a Crown mineral, an application for a mining lease will have to be lodged.

If you are unsure whether a mining title is required for your proposal you should contact NSW Department of Planning & Environment, Resources & Geoscience Division.

Department of Planning & Environment
Resource Assessments
GPO Box 39
Sydney NSW 2001

Attention: Rob Beckett, Environmental Assessment Officer

Notice Number	1565601
File Number	DOC18/359977
Date	13-Jun-2018

Dear Mr Beckett

RE: Proposed extension of area of extraction of sand from the Shoalhaven River - SAM8888 Pty Limited - Terara Shoalhaven Sands - EAR ID No. 1234

I refer to your request for the Environment Protection Authority's (EPA) requirements for the preparation of an Environmental Impact Statement (EIS) in regard to the above proposal received by EPA on 28 May 2018.

The EPA has considered the details of the proposal as provided by the Department of Planning & Environment and has identified the information it requires to be addressed in the EIS in **Attachment A**. In summary, the EPA's key information requirements for the proposal include an adequate assessment of:

1. Water quality impacts
2. Noise and vibration
3. Soil impacts
4. Acid sulphate soil management
5. Actions that will be taken to mitigate or prevent any environmental impacts identified above

In carrying out the assessment, the proponent should refer to the relevant guidelines as listed in **Attachment B** and any relevant industry codes of practice and best practice management guidelines.

The EPA notes that Environment Protection Licence No. 3209 is already held by the Proponent for the Terara Shoalhaven Sand extraction activity. The Proponent should note that any commitments made in the EIS may be formalised as approval conditions and may also be placed as formal conditions in the licence.

If you have queries regarding or wish to discuss this matter further please contact Amanda Fletcher on 6229 7002.

Yours sincerely

.....

Stefan Press

Unit Head

South East - Queanbeyan

(by Delegation)

ATTACHMENT A: EIS REQUIREMENTS FOR

Extension of area of extraction of sediment from Shoalhaven River for the Terara Shoalhaven Sands Quarry

How to use these requirements

The EPA requirements have been structured in accordance with the DIPNR EIS Guidelines, as follows. It is suggested that the EIS follow the same structure:

A. Executive summary

B. The proposal

C. The location

D. Identification and prioritisation of issues

E. The environmental issues

F. List of approvals and licences

G. Compilation of mitigation measures

H. Justification for the proposal

A Executive summary

The executive summary should include a brief discussion of the extent to which the proposal achieves identified environmental outcomes.

B The proposal

1. Objectives of the proposal

- The objectives of the proposal should be clearly stated and refer to:
  a) the size and type of the operation, the nature of the processes and the products, by-products and wastes produced
  b) a life cycle approach to the production, use or disposal of products
  c) the anticipated level of performance in meeting required environmental standards and cleaner production principles
  d) the staging and timing of the proposal and any plans for future expansion
  e) the proposal's relationship to any other industry or facility.

2. Description of the proposal

General

- Outline the production process including:
  a) the environmental "mass balance" for the process – quantify in-flow and out-flow of materials, any points of discharge to the environment and their respective destinations (sewer, stormwater, atmosphere, recycling, landfill etc)
  b) any life-cycle strategies for the products.
- Outline cleaner production actions, including:
  a) measures to minimise waste (typically through addressing source reduction)
  b) proposals for use or recycling of by-products
  c) proposed disposal methods for solid and liquid waste
  d) air management systems including all potential sources of air emissions, proposals to re-use or treat emissions, emission levels relative to relevant standards in regulations, discharge points
  e) water management system including all potential sources of water pollution, proposals for re-use, treatment etc, emission levels of any wastewater discharged, discharge points, summary of options explored to avoid a discharge, reduce its frequency or reduce its impacts, and rationale for selection of option to discharge.
  f) soil contamination treatment and prevention systems.

- Outline construction works including:
  a) actions to address any existing soil contamination
  b) any earthworks or site clearing; re-use and disposal of cleared material (including use of spoil on-site)
  c) construction timetable and staging; hours of construction; proposed construction methods
  d) environment protection measures, including noise mitigation measures, dust control measures and erosion and sediment control measures.
- Include a site diagram showing the site layout and location of environmental controls.

Air

- Identify all sources or potential sources of air emissions from the development.
  Note: emissions can be classed as either:
  - *point (e.g. emissions from stack or vent) or*
  - *fugitive (from wind erosion, leakages or spillages, associated with loading or unloading, conveyors, storage facilities, plant and yard operation, vehicle movements (dust from road, exhausts, loss from load), land clearing and construction works).*
- Provide details of the project that are essential for predicting and assessing air impacts including:
  a) the quantities and physio-chemical parameters (e.g. concentration, moisture content, bulk density, particle sizes etc) of materials to be used, transported, produced or stored
  b) an outline of procedures for handling, transport, production and storage
  c) the management of solid, liquid and gaseous waste streams with potential to generate emissions to air.

Noise and vibration

- Identify all noise sources or potential sources from the development (including both construction and operation phases). Detail all potentially noisy activities including ancillary activities such as transport of goods and raw materials.
- Specify the times of operation for all phases of the development and for all noise producing activities.
- For projects with a significant potential traffic noise impact provide details of road alignment (include gradients, road surface, topography, bridges, culverts etc), and land use along the proposed road and measurement locations – diagrams should be to a scale sufficient to delineate individual residential blocks.

Water

- Provide details of the project that are essential for predicting and assessing impacts to waters including:
  a) the quantity and physio-chemical properties of all potential water pollutants and the risks they pose to the environment and human health, including the risks they pose to Water Quality Objectives in the ambient waters (as defined on http://www.environment.nsw.gov.au/ieo/index.htm, using technical

criteria derived from *the Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, ANZECC 2000)

b) the management of discharges with potential for water impacts

c) drainage works and associated infrastructure; land-forming and excavations; working capacity of structures; and water resource requirements of the proposal.

- Outline site layout, demonstrating efforts to avoid proximity to water resources (especially for activities with significant potential impacts e.g. effluent ponds) and showing potential areas of modification of contours, drainage etc.
- Outline how total water cycle considerations are to be addressed showing total water balances for the development (with the objective of minimising demands and impacts on water resources). Include water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.

Waste and chemicals

Provide details of the quantity and type of both liquid waste and non-liquid waste generated, handled, processed or disposed of at the premises. Waste must be classified according to the EPA's *Waste Classification Guidelines 2014 (as amended from time to time)*

- Provide details of liquid waste and non-liquid waste management at the facility, including:
  a) the transportation, assessment and handling of waste arriving at or generated at the site
  b) any stockpiling of wastes or recovered materials at the site
  c) any waste processing related to the facility, including reuse, recycling, reprocessing (including composting) or treatment both on- and off-site
  d) the method for disposing of all wastes or recovered materials at the facility
  e) the emissions arising from the handling, storage, processing and reprocessing of waste at the facility
  f) the proposed controls for managing the environmental impacts of these activities.
- Provide details of spoil disposal with particular attention to:
  a) the quantity of spoil material likely to be generated
  b) proposed strategies for the handling, stockpiling, reuse/recycling and disposal of spoil
  c) the need to maximise reuse of spoil material in the construction industry
  d) identification of the history of spoil material and whether there is any likelihood of contaminated material, and if so, measures for the management of any contaminated material
  e) designation of transportation routes for transport of spoil.
- Provide details of procedures for the assessment, handling, storage, transport and disposal of all hazardous and dangerous materials used, stored, processed or disposed of at the site, in addition to the requirements for liquid and non-liquid wastes.
- Provide details of the type and quantity of any chemical substances to be used or stored and describe arrangements for their safe use and storage.

- Reference should be made to the guidelines: EPA's *Waste Classification Guidelines 2014 (as amended from time to time)*

Ecologically Sustainable Development - ESD

- Demonstrate that the planning process and any subsequent development incorporates objectives and mechanisms for achieving ESD, including:
  a) an assessment of a range of options available for use of the resource, including the benefits of each option to future generations;
  b) proper valuation and pricing of environmental resources;
  c) identification of who will bear the environmental costs of the proposal.

3. Rehabilitation

- Outline considerations of site maintenance, and proposed plans for the final condition of the site (ensuring its suitability for future uses).

4. Consideration of alternatives and justification for the proposal

- Consider the environmental consequences of adopting alternatives, including alternative:
  a) sites and site layouts
  b) access modes and routes
  c) materials handling and production processes
  d) waste and water management
  e) impact mitigation measures
  f) energy sources
- Selection of the preferred option should be justified in terms of:
  a) ability to satisfy the objectives of the proposal
  b) relative environmental and other costs of each alternative
  c) acceptability of environmental impacts and contribution to identified environmental objectives
  d) acceptability of any environmental risks or uncertainties
  e) reliability of proposed environmental impact mitigation measures
  f) efficient use (including maximising re-use) of land, raw materials, energy and other resources.

C The location

1. General

- Provide an overview of the affected environment to place the proposal in its local and regional environmental context including:
  a) meteorological data (e.g. rainfall, temperature and evaporation, wind speed and direction)
  b) topography (landform element, slope type, gradient and length)
  c) surrounding land uses (potential synergies and conflicts)
  d) geomorphology (rates of landform change and current erosion and deposition processes)
  e) soil types and properties (including erodibility; engineering and structural properties; dispersibility; permeability; presence of acid sulfate soils and potential acid sulfate soils)
  f) ecological information (water system habitat, vegetation, fauna)
  g) availability of services and the accessibility of the site for passenger and freight transport.

2. Air

- Describe the topography and surrounding land uses. Provide details of the exact locations of dwellings, schools and hospitals. Where appropriate provide a perspective view of the study area such as the terrain file used in dispersion models.
- Describe surrounding buildings that may effect plume dispersion.
- Provide and analyse site representative data on following meteorological parameters:
  a) temperature and humidity
  b) rainfall, evaporation and cloud cover
  c) wind speed and direction
  d) atmospheric stability class
  e) mixing height (the height that emissions will be ultimately mixed in the atmosphere)
  f) katabatic air drainage
  g) air re-circulation.

3. Noise and vibration

- Identify any noise sensitive locations likely to be affected by activities at the site, such as residential properties, schools, churches, and hospitals. Typically the location of any noise sensitive locations in relation to the site should be included on a map of the locality.
- Identify the land use zoning of the site and the immediate vicinity and the potentially affected areas.

4. Water

- Describe the catchment including proximity of the development to any waterways and provide an assessment of their sensitivity/significance from a public health, ecological and/or economic perspective. The Water Quality and River Flow Objectives on the website: http://www.environment.nsw.gov.au/ieo/index.htm should be used to identify the agreed environmental values and human uses for any affected waterways. This will help with the description of the local and regional area.

5. Soil Contamination Issues

- Provide details of site history – if earthworks are proposed, this needs to be considered with regard to possible soil contamination, for example if the site was previously a landfill site or if irrigation of effluent has occurred.

D Identification and prioritisation of issues / scoping of impact assessment

- Provide an overview of the methodology used to identify and prioritise issues. The methodology should take into account:
  a) relevant NSW government guidelines
  b) industry guidelines
  c) EIS's for similar projects
  d) relevant research and reference material
  e) relevant preliminary studies or reports for the proposal
  f) consultation with stakeholders.
- Provide a summary of the outcomes of the process including:
  a) all issues identified including local, regional and global impacts (e.g. increased/decreased greenhouse emissions)
  b) key issues which will require a full analysis (including comprehensive baseline assessment)
  c) issues not needing full analysis though they may be addressed in the mitigation strategy
  d) justification for the level of analysis proposed (the capacity of the proposal to give rise to high concentrations of pollution compared with the ambient environment or environmental outcomes is an important factor in setting the level of assessment).

E The environmental issues

1. General

- The potential impacts identified in the scoping study need to be assessed to determine their significance, particularly in terms of achieving environmental outcomes, and minimising environmental pollution.
- Identify gaps in information and data relevant to significant impacts of the proposal and any actions proposed to fill those information gaps so as to enable development of appropriate management and mitigation measures. This is in accordance with ESD requirements.

  Note: The level of detail should match the level of importance of the issue in decision making which is dependent on the environmental risk.

Describe baseline conditions

- Provide a description of existing environmental conditions for any potential impacts.

Assess impacts

- For any potential impacts relevant for the assessment of the proposal provide a detailed analysis of the impacts of the proposal on the environment including the cumulative impact of the proposal on the receiving environment especially where there are sensitive receivers.
- Describe the methodology used and assumptions made in undertaking this analysis (including any modelling or monitoring undertaken) and indicate the level of confidence in the predicted outcomes and the resilience of the environment to cope with the predicted impacts.
- The analysis should also make linkages between different areas of assessment where necessary to enable a full assessment of environmental impacts e.g. assessment of impacts on air quality will often need to draw on the analysis of traffic, health, social, soil and/or ecological systems impacts; etc.
- The assessment needs to consider impacts at all phases of the project cycle including: exploration (if relevant or significant), construction, routine operation, start-up operations, upset operations and decommissioning if relevant.
- The level of assessment should be commensurate with the risk to the environment.

Describe management and mitigation measures

- Describe any mitigation measures and management options proposed to prevent, control, abate or mitigate identified environmental impacts associated with the proposal and to reduce risks to human health and prevent the degradation of the environment. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.
- Proponents are expected to implement a 'reasonable level of performance' to minimise environmental impacts. The proponent must indicate how the proposal meets reasonable levels of performance. For example, reference technology based criteria if available, or identify good practice for this type of activity or development. A 'reasonable level of performance' involves adopting and implementing technology and management practices to achieve certain pollutant emissions levels in economically viable operations. Technology-based criteria evolve gradually over time as technologies and practices change.

- Use environmental impacts as key criteria in selecting between alternative sites, designs and technologies, and to avoid options having the highest environmental impacts.
- Outline any proposed approach (such as an Environmental Management Plan) that will demonstrate how commitments made in the EIS will be implemented. Areas that should be described include:

a. operational procedures to manage environmental impacts
b. monitoring procedures
c. training programs
d. community consultation
e. complaint mechanisms including site contacts
f. strategies to use monitoring information to improve performance
g. strategies to achieve acceptable environmental impacts and to respond in event of exceedences.

2. Air

Describe baseline conditions

- Provide a description of existing air quality and meteorology, using existing information and site representative ambient monitoring data. This description should include the following parameters:

a. Dust deposition;
b. Air particulates, PM_{10}, $PM_{2.5}$;
c. Odour

Assess impacts

- Identify all pollutants of concern and estimate emissions by quantity (and size for particles), source and discharge point.
- Estimate the resulting ground level concentrations of all pollutants. Where necessary (e.g. potentially significant impacts and complex terrain effects), use an appropriate dispersion model to estimate ambient pollutant concentrations. Discuss choice of model and parameters with the EPA.
- Describe the effects and significance of pollutant concentration on the environment, human health, amenity and regional ambient air quality standards or goals.
- Describe the contribution that the development will make to regional and global pollution, particularly in sensitive locations.
- For potentially odorous emissions provide the emission rates in terms of odour units (determined by techniques compatible with EPA procedures). Use sampling and analysis techniques for individual or complex odours and for point or diffuse sources, as appropriate.

  Note: With dust and odour, it may be possible to use data from existing similar activities to generate emission rates.

- Reference should be made to:

- *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2016);*
- *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (EPA, 2016);*
- *Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW (DEC, 2006);*
- *Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW (DEC, 2006).*

Describe management and mitigation measures

- Outline specifications of pollution control equipment (including manufacturer's performance guarantees where available) and management protocols for both point and fugitive emissions. Where possible, this should include cleaner production processes.

3. Noise and vibration

Describe baseline conditions

- Determine the existing background (LA90) and ambient (LAeq) noise levels in accordance with the *Noise Policy for Industry (2017).*
- Determine the existing road traffic noise levels in accordance with the *NSW Road Noise Policy*, where road traffic noise impacts may occur.
- The noise impact assessment report should provide details of all monitoring of existing ambient noise levels including:
  a) details of equipment used for the measurements
  b) a brief description of where the equipment was positioned
  c) a statement justifying the choice of monitoring site, including the procedure used to choose the site, having regards to the definition of 'noise sensitive land uses' and 'reasonably most affected location' described in the Glossary of the *Noise Policy for Industry*
  d) details of the exact location of the monitoring site and a description of land uses in surrounding areas
  e) a description of the dominant and background noise sources at the site
  f) day, evening and night assessment background levels for each day of the monitoring period
  g) the final Rating Background Level (RBL) value
  h) graphs of the measured noise levels for each day should be provided
  i) a record of periods of affected data (due to adverse weather and extraneous noise), methods used to exclude invalid data and a statement indicating the need for any re-monitoring under Step 1 in Section B1.3 of the *Noise Policy for Industry*
  j) determination of LAeq noise levels from existing industry.

Assess impacts

- Determine the project specific noise levels for the site. For each identified potentially affected receiver, this should include:
  a) determination of the intrusive criterion for each identified potentially affected receiver
  b) selection and justification of the appropriate amenity category for each identified potentially affected receiver
  c) determination of the amenity criterion for each receiver
  d) determination of the appropriate sleep disturbance limit.
- Maximum noise levels during night-time period (10pm-7am) should be assessed to analyse possible affects on sleep. Where LA1(1min) noise levels from the site are less than 15 dB above the background LA90 noise level, sleep disturbance impacts are unlikely. Where this is not the case, further analysis is required.
- Determine expected noise level and noise character (e.g. tonality, impulsiveness, vibration, etc) likely to be generated from noise sources during:
  a) site establishment
  b) construction
  c) operational phases
  d) transport including traffic noise generated by the proposal
  e) other services.

  Note: The noise impact assessment report should include noise source data for each source in 1/1 or 1/3 octave band frequencies including methods for references used to determine noise source levels. Noise source levels and characteristics can be sourced from direct measurement of similar activities or from literature (if full references are provided).
- Determine the noise levels likely to be received at the most sensitive locations (these may vary for different activities at each phase of the development). Potential impacts should be determined for any identified significant adverse meteorological conditions. Predicted noise levels under calm conditions may also aid in quantifying the extent of impact where this is not the most adverse condition.
- The noise impact assessment report should include:
  a) a plan showing the assumed location of each noise source for each prediction scenario
  b) a list of the number and type of noise sources used in each prediction scenario to simulate all potential significant operating conditions on the site
  c) any assumptions made in the predictions in terms of source heights, directivity effects, shielding from topography, buildings or barriers, etc
  d) methods used to predict noise impacts including identification of any noise models used. Where modelling approaches other than the use of the ENM or SoundPlan computer models are adopted, the approach should be appropriately justified and validated
  e) an assessment of appropriate weather conditions for the noise predictions including reference to any weather data used to justify the assumed conditions

f) the predicted noise impacts from each noise source as well as the combined noise level for each prediction scenario under any identified significant adverse weather conditions as well as calm conditions where appropriate

g) for developments where a significant level of noise impact is likely to occur, noise contours for the key prediction scenarios should be derived

h) an assessment of the need to include modification factors as detailed in Fact Sheet C of the *Noise Policy for Industry*.

- Discuss the findings from the predictive modelling and, where relevant noise criteria have not been met, recommend additional mitigation measures.
- The noise impact assessment report should include details of any mitigation proposed including the attenuation that will be achieved and the revised noise impact predictions following mitigation.
- Where relevant noise/vibration criteria cannot be met after application of all feasible and cost effective mitigation measures the residual level of noise impact needs to be quantified by identifying:

  a) locations where the noise level exceeds the criteria and extent of exceedence

  b) numbers of people (or areas) affected

  c) times when criteria will be exceeded

  d) likely impact on activities (speech, sleep, relaxation, listening, etc)

  e) change on ambient conditions

  f) the result of any community consultation or negotiated agreement.

- For the assessment of existing and future traffic noise, details of data for the road should be included such as assumed traffic volume; percentage heavy vehicles by time of day; and details of the calculation process. These details should be consistent with any traffic study carried out in the EIS.
- Where blasting is intended an assessment in accordance with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) should be undertaken. The following details of the blast design should be included in the noise assessment:

  a) bench height, burden spacing, spacing burden ratio

  b) blast hole diameter, inclination and spacing

  c) type of explosive, maximum instantaneous charge, initiation, blast block size, blast frequency.

Describe management and mitigation measures

- Determine the most appropriate noise mitigation measures and expected noise reduction including both noise controls and management of impacts for both construction and operational noise. This will include selecting quiet equipment and construction methods, noise barriers or acoustic screens, location of stockpiles, temporary offices, compounds and vehicle routes, scheduling of activities, etc.
- For traffic noise impacts, provide a description of the ameliorative measures considered (if required), reasons for inclusion or exclusion, and procedures for calculation of noise levels including ameliorative measures. Also include, where necessary, a discussion of any potential problems associated with the proposed ameliorative measures, such as overshadowing effects from barriers. Appropriate ameliorative measures may include:

a) use of alternative transportation modes, alternative routes, or other methods of avoiding the new road usage

b) control of traffic (eg: limiting times of access or speed limitations)

c) resurfacing of the road using a quiet surface

d) use of (additional) noise barriers or bunds

e) treatment of the façade to reduce internal noise levels buildings where the night-time criteria is a major concern

f) more stringent limits for noise emission from vehicles (i.e. using specially designed 'quiet' trucks and/or trucks to use air bag suspension

g) driver education

h) appropriate truck routes

i) limit usage of exhaust breaks

j) use of premium muffles on trucks

k) reducing speed limits for trucks

l) ongoing community liaison and monitoring of complaints

m) phasing in the increased road use.

4. Water

Describe baseline conditions

- Describe existing surface and groundwater quality – an assessment needs to be undertaken for any water resource likely to be affected by the proposal and for all conditions (e.g. a wet weather sampling program is needed if runoff events may cause impacts).

  Note: Methods of sampling and analysis need to conform with an accepted standard (e.g. Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC 2004) *or be approved and analyses undertaken by accredited laboratories).*

- Provide site drainage details and surface runoff yield.
- State the ambient Water Quality and River Flow Objectives for the receiving waters. These refer to the community's agreed environmental values and human uses endorsed by the Government as goals for the ambient waters. These environmental values are published on the website: http://www.environment.nsw.gov.au/ieo/index.htm. The EIS should state the environmental values listed for the catchment and waterway type relevant to your proposal.

  NB: A consolidated and approved list of environmental values are not available for groundwater resources. Where groundwater may be affected the EIS should identify appropriate groundwater environmental values and justify the choice.

- State the indicators and associated trigger values or criteria for the identified environmental values. This information should be sourced from the ANZECC 2000 *Guidelines for Fresh and Marine Water Quality* (http://www.environment.gov.au/water/publications/quality/nwqms-guidelines-4-vol1.html) (Note that, as at 2004, the NSW Water Quality Objectives booklets and website contain technical criteria derived from the 1992 version of the ANZECC Guidelines. The Water Quality Objectives remain as Government Policy, reflecting the community's environmental values and long-term goals, but the technical criteria are replaced by the more recent ANZECC 2000 Guidelines).

  NB: While specific guidelines for groundwater are not available, the ANCECC 2000 Guidelines endorse the application of the trigger values and decision trees as a tool to assess risk to environmental values in groundwater.

- State any locally specific objectives, criteria or targets, which have been endorsed by the government e.g. the Healthy Rivers Commission Inquiries (http://www.nrc.nsw.gov.au) or the NSW Salinity Strategy (DLWC, 2000) (http://www.environment.nsw.gov.au/salinity/government/nswstrategy.htm).
- Where site specific studies are proposed to revise the trigger values supporting the ambient Water Quality and River Flow Objectives, and the results are to be used for regulatory purposes (e.g. to assess whether a licensed discharge impacts on water quality objectives), then prior agreement from the EPA on the approach and study design must be obtained.
- Describe the state of the receiving waters and relate this to the relevant Water Quality and River Flow Objectives (i.e. are Water Quality and River Flow Objectives being achieved?). Proponents are generally only expected to source available data and information. However, proponents of large or high risk developments may be required to collect some ambient water quality/river flow/groundwater data to enable a suitable level of impact assessment. Issues to include in the description of the receiving waters could include:

  a) lake or estuary flushing characteristics

  b) specific human uses (e.g. exact location of drinking water offtake)

c) sensitive ecosystems or species conservation values

d) a description of the condition of the local catchment e.g. erosion levels, soils, vegetation cover, etc

e) an outline of baseline groundwater information, including, but not restricted to, depth to watertable, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment

f) historic river flow data where available for the catchment.

Assess impacts

- No proposal should breach clause 120 of the *Protection of the Environment Operations Act* 1997 (i.e. pollution of waters is prohibited unless undertaken in accordance with relevant regulations).
- Identify and estimate the quantity of all pollutants that may be introduced into the water cycle by source and discharge point including residual discharges after mitigation measures are implemented.
- Include a rationale, along with relevant calculations, supporting the prediction of the discharges.
- Describe the effects and significance of any pollutant loads on the receiving environment. This should include impacts of residual discharges through modelling, monitoring or both, depending on the scale of the proposal. Determine changes to hydrology (including drainage patterns, surface runoff yield, flow regimes, wetland hydrologic regimes and groundwater).
- Describe water quality impacts resulting from changes to hydrologic flow regimes (such as nutrient enrichment or turbidity resulting from changes in frequency and magnitude of stream flow).
- Identify any potential impacts on quality or quantity of groundwater describing their source.
- Identify potential impacts associated with geomorphological activities with potential to increase surface water and sediment runoff or to reduce surface runoff and sediment transport. Also consider possible impacts such as bed lowering, bank lowering, instream siltation, floodplain erosion and floodplain siltation.
- Identify impacts associated with the disturbance of acid sulfate soils and potential acid sulfate soils.
- Containment of spills and leaks shall be in accordance with EPA's guidelines section 'Bunding and Spill Management' at http://www.epa.nsw.gov.au/mao/bundingspill.htm and the most recent versions of the Australian Standards referred to in the Guidelines. Containment should be designed for no-discharge.
- The significance of the impacts listed above should be predicted. When doing this it is important to predict the ambient water quality and river flow outcomes associated with the proposal and to demonstrate whether these are acceptable in terms of achieving protection of the Water Quality and River Flow Objectives. In particular the following questions should be answered:

  a. will the proposal protect Water Quality and River Flow Objectives where they are currently achieved in the ambient waters; and

  b. will the proposal contribute towards the achievement of Water Quality and River Flow Objectives over time, where they are not currently achieved in the ambient waters.

- Consult with the EPA as soon as possible if a mixing zone is proposed (a mixing zone could exist where effluent is discharged into a receiving water body, where the quality of the water being discharged does not immediately meet water quality objectives. The mixing zone could result in dilution, assimilation and decay of the effluent to allow water quality objectives to be met further downstream, at the edge of the mixing zone). The EPA will advise the proponent under what conditions a mixing zone will and will not be acceptable, as well as the information and modelling requirements for assessment.

Note: The assessment of water quality impacts needs to be undertaken in a total catchment management context to provide a wide perspective on development impacts, in particular cumulative impacts.

- Where a licensed discharge is proposed, provide the rationale as to why it cannot be avoided through application of a reasonable level of performance, using available technology, management practice and industry guidelines.
- Where a licensed discharge is proposed, provide the rationale as to why it represents the best environmental outcome and what measures can be taken to reduce its environmental impact.
- Reference should be made to:
  a. *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004),
  b. *Guidelines for Fresh and Marine Water Quality* ANZECC 2000).

Describe management and mitigation measures

- Outline stormwater management to control pollutants at the source and contain them within the site. Also describe measures for maintaining and monitoring any stormwater controls.
- Outline erosion and sediment control measures directed at minimising disturbance of land, minimising water flow through the site and filtering, trapping or detaining sediment. Also include measures to maintain and monitor controls as well as rehabilitation strategies.
- Describe waste water treatment measures that are appropriate to the type and volume of waste water and are based on a hierarchy of avoiding generation of waste water; capturing all contaminated water (including stormwater) on the site; reusing/recycling waste water; and treating any unavoidable discharge from the site to meet specified water quality requirements.
- Outline pollution control measures relating to storage of materials, possibility of accidental spills (e.g. preparation of contingency plans), appropriate disposal methods, and generation of leachate.
- Describe hydrological impact mitigation measures including:
  a) site selection (avoiding sites prone to flooding and waterlogging, actively eroding or affected by deposition)
  b) minimising runoff
  c) minimising reductions or modifications to flow regimes
  d) avoiding modifications to groundwater.
- Describe groundwater impact mitigation measures including:
  a) site selection
  b) retention of native vegetation and revegetation
  c) artificial recharge
  d) providing surface storages with impervious linings
  e) monitoring program.
- Describe geomorphological impact mitigation measures including:
  a) site selection

b) erosion and sediment controls

c) minimising instream works

d) treating existing accelerated erosion and deposition

e) monitoring program.

- Any proposed monitoring should be undertaken in accordance with the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (DEC 2004).

5. Soils and contamination

Describe baseline conditions

- Provide any details (in addition to those provided in the location description - Section C) that are needed to describe the existing situation in terms of soil types and properties and soil contamination.

Assess impacts

- Identify any likely impacts resulting from the construction or operation of the proposal, including the likelihood of:

  a) disturbing any existing contaminated soil

  b) contamination of soil by operation of the activity

  c) subsidence or instability

  d) soil erosion

  e) disturbing acid sulfate or potential acid sulfate soils.

- Reference should be made to:

  a. *Contaminated Sites – Guidelines for Consultants Reporting on Contaminated Sites* (OEH, 2011);

  b. *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (EPA, 2015).

Describe management and mitigation measures

- Describe and assess the effectiveness or adequacy of any soil management and mitigation measures during construction and operation of the proposal including:

  a) erosion and sediment control measures

  b) proposals for site remediation – see *Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and Environment Protection Authority, 1998)

  c) proposals for the management of these soils – see *Acid Sulfate Soil Manual* (Acid Sulfate Soil Advisory Committee 1998) and *Acid Sulfate Soils Assessment Guidelines* (Acid Sulfate Soil Advisory Committee 1998).

6. Waste and chemicals

Describe baseline conditions

- Describe any existing waste or chemicals operations related to the proposal.

Assess impacts

- Assess the adequacy of proposed measures to minimise natural resource consumption and minimise impacts from the handling, transporting, storage, processing and reprocessing of waste and/or chemicals.
- Reference should be made to: the EPA's *Waste Classification Guidelines 2014 (as in force from time to time)*.

Describe management and mitigation measures

- Outline measures to minimise the consumption of natural resources.
- Outline measures to avoid the generation of waste and promote the re-use and recycling and reprocessing of any waste.
- Outline measures to support any approved regional or industry waste plans.

7. Cumulative impacts

- Identify the extent that the receiving environment is already stressed by existing development and background levels of emissions to which this proposal will contribute.
- Assess the impact of the proposal against the long term air, noise and water quality objectives for the area or region.
- Identify infrastructure requirements flowing from the proposal (e.g. water and sewerage services, transport infrastructure upgrades).
- Assess likely impacts from such additional infrastructure and measures reasonably available to the proponent to contain such requirements or mitigate their impacts (e.g. travel demand management strategies).

F. List of approvals and licences

- Identify all approvals and licences required under environment protection legislation including details of all scheduled activities, types of ancillary activities and types of discharges (to air, land, water).

G. Compilation of mitigation measures

- Outline how the proposal and its environmental protection measures would be implemented and managed in an integrated manner so as to demonstrate that the proposal is capable of complying with statutory obligations under EPA licences or approvals (e.g. outline of an environmental management plan).
- The mitigation strategy should include the environmental management and cleaner production principles which would be followed when planning, designing, establishing and operating the proposal. It should include two sections, one setting out the program for managing the proposal and the other outlining the monitoring program with a feedback loop to the management program.

H. Justification for the Proposal

- Reasons should be included which justify undertaking the proposal in the manner proposed, having regard to the potential environmental impacts.

ATTACHMENT B: GUIDANCE MATERIAL

Title	Web address
Relevant Legislation	
Contaminated Land Management Act 1997	http://www.legislation.nsw.gov.au/#/view/act/1997/140
Environmentally Hazardous Chemicals Act 1985	http://www.legislation.nsw.gov.au/#/view/act/1985/14
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/#/view/act/1979/203
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/#/view/act/1997/156
POEO (Clean Air) Regulation 2010	http://www.legislation.nsw.gov.au/#/view/regulation/2010/428
Water Management Act 2000	http://www.legislation.nsw.gov.au/#/view/act/2000/92
Licensing	
Guide to Licensing	https://www.epa.nsw.gov.au/licensing-and-regulation/licensing/environment-protection-licences/guide-to-licensing
Air Issues	
Air Quality	
Approved methods for modelling and assessment of air pollutants in NSW (2016)	https://www.epa.nsw.gov.au/your-environment/air/industrial-emissions/sampling-analysing-air-emissions
Noise and Vibration	
Interim Construction Noise Guideline (DECC, 2009)	https://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/interim-construction-noise-guideline
Assessing Vibration: a technical guideline (DEC, 2006)	https://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/assessing-vibration
Noise Policy for Industry (EPA, 2017)	https://www.epa.nsw.gov.au/your-environment/noise/industrial-noise/noise-policy-for-industry-(2017)
A Guide to the Noise Policy for Industry	https://www.epa.nsw.gov.au/publications/noise/17p0543-guide-to-noise-policy-for-industry
Environmental Criteria for Road Traffic Noise (EPA, 1999)	http://www.epa.nsw.gov.au/resources/noise/roadnoise.pdf
Waste, Chemicals and Hazardous Materials and Radiation	
Waste	

EPA's Waste Classification Guidelines 2014	https://www.epa.nsw.gov.au/your-environment/waste/classifying-waste/waste-classification-guidelines
Resource recovery orders and exemptions	https://www.epa.nsw.gov.au/your-environment/recycling-and-reuse/resource-recovery-framework/current-orders-and-exemption
NSW Waste Avoidance and Resource Recovery Strategy 2014-2021	https://www.epa.nsw.gov.au/your-environment/recycling-and-reuse/warr-strategy
Chemicals subject to Chemical Control Orders	
Chemical Control Orders (regulated through the EHC Act)	https://www.epa.nsw.gov.au/your-environment/chemicals/chemical-control-orders
National Protocol - Approval/Licensing of Trials of Technologies for the Treatment/Disposal of Schedule X Wastes - July 1994	Available in libraries
National Protocol for Approval/Licensing of Commercial Scale Facilities for the Treatment/Disposal of Schedule X Wastes - July 1994	Available in libraries
Water and Soils	
Acid sulphate soils	
Coastal acid sulfate soils guidance material	http://www.environment.nsw.gov.au/topics/land-and-soil/soil-degradation/acid-sulfate-soils and https://www.epa.nsw.gov.au/licensing-and-regulation/licensing/environment-protection-licences/authorised-officers/resources-and-training/acid-sulfate-soils-assess-and-manage
Acid Sulfate Soils Planning Maps	http://www.environment.nsw.gov.au/topics/land-and-soil/soil-degradation/acid-sulfate-soils
Contaminated Sites Assessment and Remediation	
Managing land contamination: Planning Guidelines – SEPP 55 Remediation of Land	https://www.epa.nsw.gov.au/your-environment/contaminated-land/managing-contaminated-land/role-of-planning-authorities
Guidelines for Consultants Reporting on Contaminated Sites (EPA, 2000)	http://www.epa.nsw.gov.au/resources/clm/20110650consultantsglines.pdf
Guidelines for the NSW Site Auditor Scheme - 2nd edition (DEC, 2006)	http://www.epa.nsw.gov.au/resources/clm/auditorglines06121.pdf
Sampling Design Guidelines (EPA, 1995)	http://www.epa.nsw.gov.au/resources/clm/95059sampgdlne.pdf
National Environment Protection (Assessment of Site Contamination) Measure 1999 (or update)	http://www.nepc.gov.au/nepms/assessment-site-contamination
Soils – general	

Managing land and soil	http://www.environment.nsw.gov.au/topics/land-and-soil/managing-land-and-soil
Managing urban stormwater for the protection of soils	http://www.environment.nsw.gov.au/stormwater/publications.htm
Site Investigations for Urban Salinity (DLWC, 2002)	http://www.environment.nsw.gov.au/resources/salinity/booklet3siteinvestigationsforurbansalinity.pdf
Local Government Salinity Initiative Booklets	http://www.environment.nsw.gov.au/topics/land-and-soil/soil-degradation/salinity/type-of-salinity-and-their-prevention
Water	
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	http://www.environment.gov.au/water/publications/quality/nwqms-guidelines-4-vol1.html
Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones	Contact the EPA on 131555
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	https://www.epa.nsw.gov.au/licensing-and-regulation/licensing/environment-protection-licences/licensing-under-poeo-act-1997/licensing-to-regulate-water-pollution/approved-methods-for-sampling-and-analysing-water-pollutants

Office of Environment & Heritage

NSW GOVERNMENT

Date: 15 June 2018
Your reference: EAR ID No. 1234
Our reference: DOC18/393587
Contact: Calvin Houlison
4224 4179

Rob Beckett
Environmental Assessment Officer
Department of Planning & Environment
GPO Box 39
SYDNEY NSW 2001
E-mail: rob.beckett@planning.nsw.gov.au

Dear Mr Beckett

RE: Project Extension, Terara Shoalhaven Sand Quarry, Terara (EAR ID No. 1234)

Thank you for the opportunity to provide input into local Environmental Assessment Requirements (EARs) for the proposed project extension to Terara Shoalhaven Sand Quarry. The proposal has been identified as designated development under Schedule 3 of the Environmental Planning & Assessment Regulation 2000, due to the proposed extraction area disturbing more than 2 hectares of land within a "natural waterbody" (the Shoalhaven River).

Suggested assessment requirements for biodiversity, Aboriginal cultural heritage, flooding and water quality are provided at Attachment A, and a summary of key issues is provided below.

Biodiversity

No native vegetation clearing is proposed as the proposed extractive industry is located within the riverine environment. Notwithstanding the project's location, impacts upon threatened species and ecological communities listed under the Biodiversity Conservation Act 2016 (BC Act) must be addressed. Impacts resulting from any land side works above mean water high mark on the Shoalhaven River, such as storage, stockpiling and the like, must also be assessed.

Threatened shorebirds are known to be present within the vicinity, such as Ospreys which are known for nesting, feeding and fishing within this part of the Shoalhaven River. Other threatened shorebirds have been recorded in this part of the river. If the threatened species assessment concludes that the proposed development is "likely to significantly threatened species" under Section 7.3 of the BC Act, then a Biodiversity Development Assessment Report (BDAR) is required.

Additional prescribed impacts upon biodiversity under Clause 6.1 of the Biodiversity Conservation Regulation 2017 (BC Regs) must also be considered. These particularly include matters such as *"impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological processes"*. Such impacts "may", but are not "required", to be taken into account when determining any biodiversity offset requirements for the proposal.

Aboriginal cultural heritage

The Shoalhaven River is part of a highly significant Aboriginal cultural landscape. While there are no recorded Aboriginal objects within the study area, there are recorded sites nearby. The absence of

recorded sites in the immediate vicinity of the Terara Shoalhaven Sands facility may be because the area has not been archaeologically surveyed, rather than due to an actual absence of Aboriginal heritage sites.

Given this broader cultural landscape, and the nature of the proposed development, we have the following recommendations in relation to Aboriginal cultural heritage:

- The works on shore must be assessed to determine whether harm to Aboriginal objects is likely to occur through the proposed increase in the volume of sand processing.
- The effect of the increased dredging area on the shoreline must be monitored. If erosion of the shore is accentuated by the increased dredging area, the potential of that erosion to impact Aboriginal objects must be assessed.

Floodplain Risk Management

The flood assessment component of the EIS should consider the potential for flood impacts across the Lower Shoalhaven River floodplain. We understand that Shoalhaven City Council is in the process of undertaking an updated floodplain risk management study of the whole Lower Shoalhaven River and floodplains to contemporary standards. We therefore suggest that the proponent consult with Council in this regard to achieve consistency with the flood modelling and analysis required for the EIS.

Water Quality

The proposal has the potential to impact on estuary health including estuarine vegetation and water quality. Therefore, water quality assessment requirements to characterise potential impacts and relevant avoidance and mitigation provisions have been provided at Attachment A. In addition, the EIS must also demonstrate and document how the proposed development is consistent with the requirements of the SEPP (Coastal Management) 2018 and the objectives of the 'Coastal environment area' under the Coastal Management Act 2016, within which the subject site is mapped.

Please do not hesitate to contact Calvin Houlison, Senior Conservation Planning Officer on 4224 4179 or e-mail calvin.houlison@environment.nsw.gov.au should you require any further information.

Yours sincerely

CHRIS PAGE
Senior Team Leader, Planning (Illawarra)
South East Region
Regional Operations Division

Attachment A: OEH Suggested EARs for Proposed Project Extension, Terara Shoalhaven Sand Quarry
Attachment B: OEH Guidance Material

pp

ATTACHMENT A: OEH SUGGESTED ENVIRONMENTAL ASSESSMENT REQUIREMENTS FOR PROPOSED PROJECT EXTENSION, TERARA SHOALHAVEN SAND QUARRY

1. Biodiversity

Biodiversity Assessment Methodology for the Biodiversity Offsets Scheme (BOS)

The EIS should include an assessment of the following:

a. The EIS must assess the impact of the proposed development on biodiversity values to determine if the proposed development is "likely to significantly affect threatened species" for the purposes of Section 7.2 of the Biodiversity Conservation Act 2016 (BC Act), as follows:

   a. The EIS must demonstrate and document how the proposed development exceeds, or does not exceed, the biodiversity offsets scheme threshold as set out in Section 7.4 of the BC Act 2016 and Clause 7.1 of the Biodiversity Conservation Regulation 2017 (BC Regulation) by determining whether the proposed development involves:

      i. **The clearing of native vegetation exceeds the thresholds** listed under Clause 7.23 of the BC Regulation, **or**

      ii. The clearing of native vegetation, or other action, **on land included on the Biodiversity Values Map** published under Clause 7.23 of the BC Regulation (this map includes areas of outstanding biodiversity value, as declared under Section 3.1 of the BC Act).

   b. If the proposal does not trigger any of the criteria in (a) above, then the EIS must determine whether the proposed development is likely to have a significant impact based on '*the test for determining whether proposed development likely to significant affect threatened species or ecological communities'* in Section 7.3 of the BC Act.

   c. Where there is reasonable doubt regarding potential impacts, or where information is not available, then a significant impact upon biodiversity should be considered likely when applying the test in Section 7.3 of the BC Act. Where it is concluded that there is no significant impact, the EIS must justify how the conclusion has been reached.

   d. If the development exceeds the thresholds in (a) or (b), then the EIS must be accompanied by a biodiversity development assessment report (BDAR) prepared in accordance with Part 6 of the BC Act. That is, the Biodiversity Assessment Methodology applies.

Required Information

Where development is considered "likely to significantly impact on threatened species" and a Biodiversity Development Assessment Report is required, the following requirements apply:

- Biodiversity impacts related to the proposal are to be assessed in accordance with the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the *Biodiversity Conservation Act 2016* (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and Biodiversity Assessment Method.
- The BDAR must document the application of the avoid, minimise and offset hierarchy including assessing all direct, indirect and prescribed impacts in accordance with the Biodiversity Assessment Method.
- The BDAR must include details of the measures proposed to address the offset obligation as follows:
    - The total number and classes of biodiversity credits required to be retired for the proposal.
    - The number and classes of like-for-like biodiversity credits proposed to be retired.
    - The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules.
    - Any proposal to fund a biodiversity conservation action.
    - Any proposal to make a payment to the Biodiversity Conservation Fund.
- If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.

The BDAR must be prepared by a person accredited to apply the Biodiversity Assessment Method under s6.10 of the *Biodiversity Conservation Act 2016*.

Where a BDAR is not required and a threatened species assessment is prepared to support a conclusion of "no significant impact", the EIS must include a field survey of the site, conducted and documented in accordance with the relevant guidelines including the Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians (DECCW, 2009), Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft (DEC, 2004) and Guidelines for Threatened Species Assessment (Dept Planning, July 2005). The approach should also reference the field survey methods and assessment information on the OEH website including the Bionet Atlas, Threatened Species Profile and Bionet Vegetation Classification (see Attachment 2).

Project specific requirements

- The proposal must address additional prescribed impacts under Clause 6.1 of the BC Regs. Notably, Clasue 6.1(1)(d) states that *"impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological processes"* must be assessed under the biodiversity offsets scheme. Such impacts "may", but are not "required", to be taken into account when determining any biodiversity offset requirements for the proposal.

2. Aboriginal Cultural Heritage

Required Information

- The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the proposal. This may include the need for surface survey and test excavation. The identification of cultural heritage values must be conducted in accordance with the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW (OEH 2010), and be guided by the Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW (DECCW, 2011) and consultation with OEH regional branch officers.
- If you do not know whether a proposal may harm Aboriginal objects or declared Aboriginal places, it may be appropriate to apply the due diligence procedure as prescribed under the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (OEH 2011). The due diligence must indicate whether further assessment under an Aboriginal Cultural Heritage Report (ACHAR) is required. An assessment under the Due Diligence process is not an ACHAR.
- If Aboriginal cultural heritage values or potential values are likely to be harmed by the proposed works, these are to be assessed and documented in an Aboriginal Cultural Heritage Assessment Report (ACHAR). An assessment under the Due Diligence process is not an Aboriginal Cultural Heritage Assessment Report. The ACHAR must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the ACHAR must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.
- Consultation with Aboriginal people must be undertaken and documented in accordance with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW) where an ACHAR is required. The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the ACHAR.
- Where harm to an Aboriginal object or declared Aboriginal place cannot be avoided, an Aboriginal Heritage Impact Permit (AHIP) will be required from OEH under the National Parks and Wildlife Act 1974. You must apply to OEH for an AHIP prior to commencing works that will directly or indirectly harm an Aboriginal object or a declared Aboriginal place.
- If Aboriginal objects are found at any stage of the life of the development and an AHIP has not been issued for harm to those objects, then work must stop and OEH must be contacted by calling 131 555. An AHIP application will be required where harm to Aboriginal objects cannot be avoided.
- In the event that Aboriginal burials or skeletal material is found during works all work must stop and NSW Police must be contacted. OEH must also be contacted by calling 131 555.

3. Floodplain Risk Management

Required Information

- The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including:
    - Flood prone land (ie land susceptible to the probable maximum flood event).
    - Flood planning area, the area below the flood planning level.
    - Hydraulic categorisation (floodway and flood storage areas).
    - Flood hazard.
- The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 10% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or an equivalent extreme event.
- The EIS must model the effect of the proposal (including fill) on the current flood behaviour for a range of design events as identified above, and the 0.5% AEP and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.
- All site drainage, stormwater quality devices and erosion / sedimentation control measures should be identified in the EIS and the onsite treatment of stormwater and effluent runoff and predicted stormwater discharge quality from the proposal should be detailed.
- Modelling in the EIS must consider and document:
    - Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies.
    - The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood (PMF), or an equivalent extreme flood.
    - Impacts of the proposal on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazard categories and hydraulic categories.
    - Impacts of earthworks and stockpiles within the flood prone land up to the PMF level. The assessment should be based on understanding of cumulative flood impacts of construction and operational phases.
    - Relevant provisions of the NSW Floodplain Development Manual 2005.
- The EIS must assess the impacts on the proposal on flood behaviour, including:
    - Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.
    - Consistency with Council floodplain risk management plans.
    - Consistency with any Rural Floodplain Management Plans.
    - Compatibility with the flood hazard of the land.
    - Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.

- Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.
- Whether there will be a direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.
- Appropriate mitigation measures to offset potential flood risk arising from the proposal. Any proposed mitigation work should be modelled and assessed on the overall catchment basis in order to ensure it fits its purpose and meets the criteria of the Council where it is located, and to ensure it has no adverse impact to surrounding areas.
- Any impacts the proposal may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the NSW SES and Council.
- Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the NSW SES and Council.
- Emergency management, evacuation and access, and contingency measures for the proposal during both construction and operational phases considering the full range of flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the NSW SES.
- Any impacts the proposal may have on the social and economic costs to the community as a consequence of flooding.

4. Water Quality

Required information

- The EIS must map features relevant to water, including:
    - Rivers, streams, estuaries (as described in s4.2 of the Biodiversity Assessment Method).
    - Wetlands (as described in s4.2 of the Biodiversity Assessment Method).
    - Groundwater.
    - Groundwater dependent ecosystems.
- The EIS must describe background conditions for any water resource likely to be affected by the proposal, including:
    - Existing surface and groundwater.
    - Hydrology
    - Water Quality Objectives (as endorsed by the NSW Government) including groundwater as appropriate that represent the community's uses and values for the receiving waters.
    - Indicators and trigger values/criteria for the identified environmental values in accordance with the ANZECC (2000) Guidelines for Fresh and Marine Water Quality and / or local objectives, criteria or targets endorsed by the NSW Government
    - Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions (OEH/EPA, 2017).
- The EIS must assess the impacts of the proposal on water quality, including:
    - The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the proposal protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction.
    - Identification of proposed monitoring of water quality.
    - Consistency with any relevant certified Coastal Management Program (or Coastal Zone Management Plan).
- The EIS must assess the impact of the proposal on hydrology, including:
    - Water balance including quantity, quality and source.
    - Effects upon rivers, wetlands, estuaries, marine waters and floodplain areas.
    - Effects upon water-dependent fauna and flora including groundwater dependent ecosystems.
    - Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches).
    - Changes to environmental water availability, both regulated / licensed and unregulated / rules-based sources of such water.

ATTACHMENT B: OEH GUIDANCE MATERIAL

Title	Web address
Relevant Legislation	
Biodiversity Conservation Act 2016	https://www.legislation.nsw.gov.au/#/view/act/2016/63/full
Coastal Management Act 2016	https://www.legislation.nsw.gov.au/#/view/act/2016/20/full
Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
Fisheries Management Act 1994	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N
Marine Parks Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+64+1997+cd+0+N
National Parks and Wildlife Act 1974	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
Water Management Act 2000	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
Wilderness Act 1987	http://www.legislation.nsw.gov.au/viewtop/inforce/act+196+1987+FIRST+0+N
Aboriginal Cultural Heritage	
Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (DECCW, 2010)	http://www.environment.nsw.gov.au/resources/cultureheritage/commconsultation/09781ACHconsultreq.pdf
Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010)	http://www.environment.nsw.gov.au/resources/cultureheritage/10783FinalArchCoP.pdf
Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011)	http://www.environment.nsw.gov.au/resources/cultureheritage/20110263ACHguide.pdf
Aboriginal Site Recording Form	http://www.environment.nsw.gov.au/resources/parks/SiteCardMainV1_1.pdf
Aboriginal Site Impact Recording Form	http://www.environment.nsw.gov.au/resources/cultureheritage/120558asirf.pdf
Aboriginal Heritage Information Management System (AHIMS) Registrar	http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm
Care Agreement Application form	http://www.environment.nsw.gov.au/resources/cultureheritage/20110914TransferObject.pdf
Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (OEH 2011)	http://www.environment.nsw.gov.au/resources/cultureheritage/ddcop/10798ddcop.pdf
Biodiversity	

Title	Web address
Biodiversity Values Map	https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap
Biodiversity Assessment Method (OEH, 2017)	http://www.environment.nsw.gov.au/resources/bcact/biodiversity-assessment-method-170206.pdf
Guidance and Criteria to assist a decision maker to determine a serious and irreversible impact (OEH, 2017)	http://www.environment.nsw.gov.au/resources/bcact/guidance-decision-makers-determine-serious-irreversible-impact-170204.pdf
Ancillary rules: Biodiversity conservation actions	http://www.environment.nsw.gov.au/resources/bcact/ancillary-rules-biodiversity-actions-170496.pdf
Ancillary rules: Reasonable steps to seek like-for-like biodiversity credits for the purpose of applying the variation rules	http://www.environment.nsw.gov.au/resources/bcact/ancillary-rules-reasonable-steps-170498.pdf
Ancillary rules: Impacts on threatened species excluded from application of the variation rules	http://www.environment.nsw.gov.au/resources/bcact/ancillary-rules-impacts-on-threatened-entities-excluded-from-variation-170497.pdf
OEH Threatened Species Profiles	http://www.environment.nsw.gov.au/threatenedspeciesapp/
BioNet Atlas	http://www.environment.nsw.gov.au/wildlifeatlas/about.htm
BioNet Vegetation Classification	http://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx
Threatened Species Profile	http://www.environment.nsw.gov.au/threatenedSpeciesApp/
NSW Guide to Surveying Threatened Plants (OEH, 2016)	http://www.environment.nsw.gov.au/research-and-publications/publications-search/nsw-guide-to-surveying-threatened-plants
Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna - Amphibians (DECC, 2009)	www.environment.nsw.gov.au/resources/Threatenedspecies/09213amphibians.pdf
Threatened Species Assessment Guideline - The Assessment of Significance (DECC 2007)	www.environment.nsw.gov.au/resources/Threatenedspecies/tsaguide07393.pdf
Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft (DEC, 2004)	http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf
Fisheries NSW policies and guidelines	http://www.dpi.nsw.gov.au/fisheries/habitat/publications/policies,-guidelines-and-manuals/fish-habitat-conservation
OEH Estate	
Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water (DECCW, 2010)	http://www.environment.nsw.gov.au/protectedareas/developmntadjoiningdecc.htm
List of national parks	http://www.environment.nsw.gov.au/NationalParks/parksearchatoz.aspx
Revocation, recategorisation and road adjustment policy (OEH, 2012)	http://www.environment.nsw.gov.au/policies/RevocationOfLandPolicy.htm
List of aquatic reserves	www.dpi.nsw.gov.au/fisheries/habitat/protecting-habitats/mpa
List of marine parks	www.mpa.nsw.gov.au/contact.html

Title	Web address
Water	
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	www.environment.gov.au/water/publications/quality/australian-and-new-zealand-guidelines-fresh-marine-water-quality-volume-1
Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions	http://www.environment.nsw.gov.au/research-and-publications/publications-search/risk-based-framework-for-considering-waterway-health-outcomes-in-strategic-land-use-planning
Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones	http://deccnet/water/resources/AWQGuidance7.pdf
Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales (DEC 2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf
Flooding	
Floodplain Development Manual	http://www.environment.nsw.gov.au/floodplains/manual.htm
Floodplain Risk Management Guidelines	http://www.environment.nsw.gov.au/topics/water/coasts-and-floodplains/floodplains/floodplain-guidelines
NSW Climate Impact Profile	http://climatechange.environment.nsw.gov.au/
Climate Change Impacts and Risk Management	Climate Change Impacts and Risk Management: A Guide for Business and Government, AGIC Guidelines for Climate Change Adaptation
Coastal Erosion	
Reforms to coastal erosion management	http://www.environment.nsw.gov.au/coasts/coastalerosionmgmt.htm
Guidelines for Preparing Coastal Zone Management Plans	http://www.environment.nsw.gov.au/resources/coasts/130224CZMPGuide.pdf
Historic Heritage	
The Burra Charter (The Australia ICOMOS charter for places of cultural significance)	http://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf
Statements of Heritage Impact 2002 (HO & DUAP)	http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/hmstatementsofhi.pdf
NSW Heritage Manual (DUAP) (scroll through alphabetical list to 'N')	http://www.environment.nsw.gov.au/Heritage/publications/
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf

Rob Beckett

From: James Bonner <James.Bonner@shoalhaven.nsw.gov.au>
Sent: Thursday, 21 June 2018 5:17 PM
To: Rob Beckett
Subject: RE: DPE request for SEARs - Terara Shoalhaven Sand Quarry project extension

Hi Rob,

Thankyou for giving Council the opportunity to provide input into the SEARS for the proposed modification application for RA12/1001. The operator has previously discussed the possibility of moving the sand filtering/dewatering process from Pig Island so that the process is conducted wholly within the property at Terara. This needs to be clarified in the environmental assessment as to how and where the whole development will operate. Council has reviewed the submitted information and provides the following comments.

Aboriginal Heritage
The Shoalhaven River is the subject of a Native Title claim.

Environmental
Council has been advised by the NSW EPA that there is the potential for PFAS contamination in the Shoalhaven River which should be included in the environmental assessment.

Traffic
The application needs to include a traffic impact assessment on the road network including the suitability of the current driveway access considering the increased life of the development.

Flooding
Council's Flood Unit are finalising their comments and I will provide those to you tomorrow morning.

Flora & Fauna Issues
The Environmental Impact Statement (EIS) prepared under Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* will require assessments for migratory species and nationally threatened species and ecological communities under the *Environmental Protection Biodiversity Act 1999*; state listed threatened species and ecological communities under the *Biodiversity Conservation Act 2016*; key fish habitats, seagrass and mangroves in accordance with the *Fisheries Management Act 1994*; and the application of the *State Environmental Planning policy (Coastal Management) 2018*.

Consideration to the applicable clauses within Part 7 of the *Shoalhaven Local Environmental Plan 2014* must be incorporated into the EIS.

Specific consideration must be given to the following vegetation communities and habitats known to occur along the Shoalhaven River:

- Mangroves
- Seagrass beds
- Mapped key fish habitats
- Bangalay Sand Forest
- Coastal Saltmarsh
- Littoral Rainforest

- Swamp Oak Floodplain Forest
- Swamp Sclerophyll Forest
- Shorebirds and their habitats

The EIS must include impact assessments for all threatened species known to occur along the Shoalhaven River:

- Australian Fur-seal *Arctocephalus pusillus doriferus*
- Bar-tailed Godwit *Limosa lapponica*
- Beach Stone-curlew *Esacus magnirostris*
- Black Bittern *Ixobrychus flavicollis*
- Black-tailed Godwit *Limosa limosa*
- Blue-billed Duck *Oxyura australis*
- Broad-billed Sandpiper *Limicola falcinellus*
- Bush Stone-curlew *Burhinus grallarius*
- Caspian Tern *Hydroprogne caspia*
- Cattle Egret *Ardea ibis*
- Common Greenshank *Tringa nebularia*
- Common Sandpiper *Actitis hypoleucos*
- Common Tern *Sterna hirundo*
- Curlew Sandpiper *Calidris ferruginea*
- Dusky Woodswallow *Artamus cyanopterus cyanopterus*
- Eastern Curlew *Numenius madagascariensis*
- Eastern Osprey *Pandion cristatus*
- Eastern Reef Egret *Egretta sacra*
- Glossy Black-Cockatoo *Calyptorhynchus lathami*
- Great Knot *Calidris tenuirostris*
- Greater Sand-plover *Charadrius leschenaultia*
- Green Turtle *Chelonia mydas*
- Grey Plover *Pluvialis squatarola*
- Grey-tailed Tattler *Tringa brevipes*
- Gull-billed Tern *Gelochelidon nilotica*
- Hooded Plover *Thinornis rubricollis*
- Humpback Whale *Megaptera novaeangliae*
- Latham's Snipe *Gallinago hardwickii*
- Lesser Sand-plover *Charadrius mongolus*
- Little Eagle *Hieraaetus morphnoides*
- Loggerhead Turtle *Sternula albifrons*
- Marsh Sandpiper *Tringa stagnatilis*
- Oriental Plover *Charadrius veredus*
- Pacific Golden Plover *Pluvialis fulva*
- Pied Oystercatcher *Haematopus longirostris*
- Red Knot *Calidris canutus*
- Red-necked Stint *Calidris ruficollis*
- Ruddy Turnstone *Arenaria interpres*
- Sanderling *Calidris alba*
- Scarlet Robin *Petroica boodang*
- Sharp-tailed Sandpiper *Calidris acuminata*
- Sharp-tailed Sandpiper *Calidris acuminate*
- Short-tailed Shearwater *Ardenna tenuirostris*
- Sooty Oystercatcher *Haematopus fuliginosus*
- Square-tailed Kite *Lophoictinia isura*

- Terek Sandpiper *Xenus cinereus*
- Wedge-tailed Shearwater *Ardenna pacificus*
- Whimbrel *Numenius phaeopus*
- White-bellied Sea-Eagle *Haliaeetus leucogaster*
- White-fronted Chat *Epthianura albifrons*
- White-throated Needletail *Hirundapus caudacutus*

The EIS must:

- Be prepared by an accredited person under the *Biodiversity Conservation Act 2016* and in accordance with the *Environmental Planning and Assessment Act 1999*.

- Be prepared in accordance with clause 7(4) of Part 3 of Schedule 2 under of the *Environmental Planning and Assessment Regulation 2000* specifying considerations to Ecologically Sustainable Development (ESD). As such, the assessment must also include determination of sand extraction to be undertaken by best practice/minimal impact extraction methods.

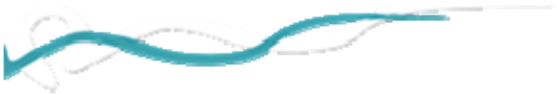
- Incorporate an assessment of all potential direct and indirect impacts from extraction to processing, including potential changes to the movement of sediments downstream to the mouth of the Shoalhaven River and how this may affect threatened marine habitats, shorebird habitats and Endangered Ecological Communities along the Shoalhaven River.

- Include any known impacts occurred from the sand extraction under RA12/1001 such as; impacts to the seagrass beds within close proximity of dredging activities, water quality, and the integrity and stability of the riverbanks along Pig Island and give reference to any monitoring reports that have been produced to date.

- Assess the impacts of disturbing class 2 high-risk acid sulfate soils within the Shoalhaven River.

Regards

James Bonner
Unit Manager – Development Services Nowra
Shoalhaven City Council
02 4429 3382
council@shoalhaven.nsw.gov.au
www.shoalhaven.nsw.gov.au



Please address all emails to council@shoalhaven.nsw.gov.au for record purposes

Rob Beckett

From: Nicholas Cavallo <Nicholas.Cavallo@shoalhaven.nsw.gov.au>
Sent: Friday, 22 June 2018 2:44 PM
To: Rob Beckett
Cc: James Bonner
Subject: RE: DPE request for SEARs - Terara Shoalhaven Sand Quarry project extension

Importance: High

Hello Rob,

James Bonner, Unit Manager – Development, is out of the office today and has requested that I forward the results of an internal assessment by Council's Floodplain Unit with regard to the matter outlined below. Their comments are as follows:

The document D18/184249 has been reviewed. It is understood that the proposed annual extraction rate of sands will be remained same but the area of dredging will be increased by multiple folds in comparison to the previous approval.

In terms of flood behaviour the dredging may not have an effect, however this will be required to be addressed to demonstrate this. The main concern would be geomorphic effect of the dredging as it may cause erosion to the river bank which could cause further sedimentation. In addition, Council has a levee system along this stretch of the river which could be compromised. A detailed assessment is required to determine the geomorphic effects the proposed degrading will have to the river and the banks

If you have any questions regarding the information that has been requested, James will return to the office on Monday.

Regards

Nicholas Cavallo
Senior Development Planner
Shoalhaven City Council
Bridge Rd (PO Box 42) NOWRA NSW 2541

02 4429 3203
Nicholas.Cavallo@shoalhaven.nsw.gov.au
www.shoalhaven.nsw.gov.au

Rob Beckett

From: Allan Lugg <allan.lugg@dpi.nsw.gov.au>
Sent: Friday, 1 June 2018 1:29 PM
To: Rob Beckett
Cc: Jillian Reynolds
Subject: RE: FW: DPE request for SEARs - Terara Shoalhaven Sand Quarry project extension - Shoalhaven River - EAR ID No. 1234

Hi Rob,
EARs for this proposed expansion include:

1. Detailed description of planned sequencing of the sand extraction operation over the 25 to 30 year proposed lifetime.
2. Details of a "resource suitability assessment" that demonstrates the suitability of sand resource for the intended use and the extent (both spatially and depth) of the suitable resource.
3. results (plan and cross sections) of a detailed bathymetric survey of the existing extraction area and proposed expansion area and a comparison of dredge depths in relation to existing project approval conditions and Crown land Licence conditions.
4. results of a detailed survey showing the existing extraction area in relation to the permitted operational area as defined by the Crown Land Licence.
5. results of detailed and targeted aquatic ecological assessment of the existing extraction area and comparison of the biological features and values of the existing extraction area with adjacent habitats not subject to extraction. The ecological assessment should include fish, aquatic macrophytes (including both Zostera and Halophila seagrasses and seaweeds) and benthic organisms such as molluscs and crustaceans.
6. results of detailed and targeted aquatic ecological assessment of the proposed extraction area. The ecological assessment should include fish, detailed mapping and assessment of aquatic macrophytes (including both Zostera and Halophila seagrasses, mangroves, saltmarsh and seaweeds) and benthic organisms.
7. an assessment of the likely impact of dredging what is effectively a deep channel around the western end and north-western side of Pig Island, upon the distribution of tidal flows and the risk this poses to sand flat and riverbank stability in the general area over the long term including during flood events.
8. an assessment of the likely impact of the proposal upon both recreational and commercial fishing activities including bait (such as squirt worm) collecting.
9. results of consultations with commercial and recreational fishing interests regarding the likely impact of the proposal upon both recreational and commercial fishing activities including bait collecting.
10. proposals to protect adjacent seagrass beds not only from the direct impacts of sand extraction but also from the risk of the batter slope slumping into the dredge hole and/or of sand being redistributed by changed water flow patterns.
11. an assessment of the likely impact of the proposal upon the mangrove community around the foreshore of Pig Island and the stability of the foreshore of Pig Island
12. proposals for ongoing monitoring of impacts (ecological and water quality).
13. outline of proposals for the progressive rehabilitation of the area including rehabilitation of existing exhausted extraction areas.
14. outline of proposals for environmental compensation to offset the disturbance to and ultimately the loss of the existing sand flat.
15. Results of an audit of compliance with existing project approval conditions and Crown Land Licence conditions including an assessment of the effectiveness of rehabilitation measures (such as shoreline revegetation) .

Note: Assuming that a Licence would be issued under the Crown Lands Act, the proposal would not require a permit for dredging under Division 3 of Part 7 of the Fisheries Management Act and hence would not be integrated development due to an exemption for works approved under the Crown Lands Act. However if the proposal

will affect seagrass, then a permit under Division 4 of Part 7 of the FM Act would be required and it would become integrated development. There are no relevant exemptions for this.

Regards Allan

Allan Lugg | Senior Fisheries Manager – Aquatic Ecosystems (South)
NSW Department of Primary Industries
4 Woollamia Road | PO Box 97 | HUSKISSON NSW 2540
T: 02 4428 3401 | F: 02 4441 8961 | M: 0409 912 686 | E: Allan.Lugg@dpi.nsw.gov.au
W: http://www.dpi.nsw.gov.au/fishing
Keeping south coast waterways *Unspoilt*
Habitat Policy and Guidelines available at:
http://www.dpi.nsw.gov.au/fishing/habitat/publications/fish-habitat-conservation
Key Fish Habitat maps and Permit Application forms available at:
http://www.dpi.nsw.gov.au/fishing/habitat/publications/key-fish-habitat-maps
Information on threatened species is available at:
http://www.dpi.nsw.gov.au/fishing/species-protection

Rob Beckett

From: Glendon Lee <Glendon.Lee@health.nsw.gov.au>
Sent: Friday, 8 June 2018 12:29 PM
To: Rob Beckett
Cc: Curtis Gregory
Subject: RE: DT18/71295 - DPE request for SEARs - Terara Shoalhaven Sand Quarry project extension

Hello Rob,

Thank you for the opportunity to contribute to the development of SEARS for this proposal.

The ISLHD Public Health Unit has considered the potential for this proposed activity to impact on human health and recommends that the proponent's EIS address the following matters in this regard:

- The suitability of the extracted material for use on residential properties or for other high risk uses from a contamination perspective. This should include an assessment of heavy metals or other contaminants that may have been introduced by nearby industrial activities and an assessment of PFAS chemicals that have recently been identified as contaminants in the Shoalhaven River. Where the extracted material is made it suitable for use by processing, the potential for these contaminants must be considered in the treatment and disposal of any waste stream.
- The potential impact on water quality in the Shoalhaven River, including upstream and downstream impacts and how water quality will be protected and maintained during extraction activities.

Please contact me if you require any further information.

Regards

Glendon Lee

Senior Environmental Health Officer
Public Health Unit, Illawarra
Locked Mail Bag 9 Wollongong NSW 2500
Address: Level 1/67-71 King Street Warrawong NSW 2502
Tel 02 4221 6700 | Fax 02 4221 6759 | glendon.lee@health.nsw.gov.au
www.health.nsw.gov.au

NSW GOVERNMENT Health
Illawarra Shoalhaven
Local Health District

Rob Beckett

From: kirstyn.goulding@crownland.nsw.gov.au on behalf of Lands Ministerials <lands.ministerials@industry.nsw.gov.au>
Sent: Monday, 18 June 2018 1:22 PM
To: Rob Beckett
Subject: DPE request for SEARs - Terara Shoalhaven Sand Quarry project extension

Hi Rob

Please find below response from DoI Crown Lands regarding the above proposal:-

1. The EIS will need to describe the areas of Endangered Ecological Communities associated with the activities and detail the measures to be undertaken to protect them during and following the extraction activities.
2. **The current Crown Land licence 145976 to Terara Sand Pty Ltd will be required to be relinquished and a new licence issued to cover the entire approved extraction area (including the existing extraction area).**
3. Development Consent for extraction of material from the proposed extension area will be required **prior to** any new licence being granted or extraction works commencing in the proposed extension area.
4. **Delineation of any approved extraction area by survey and placement of permanent marking of the surveyed boundaries (with appropriate permanent in-water markers) will be required prior to any extraction commencing from the proposed extraction area.** This permanent marking is to be maintained throughout the term of any extraction licence.
5. Extended occupation of the Crown land is required to be authorised by a Crown licence.

Thanks
Kirstyn

Lands Ministerial Unit
NSW Department of Industry - Crown Lands
Level 4, 437 Hunter Street, NEWCASTLE NSW 2300
E: lands.ministerials@industry.nsw.gov.au W: www.industry.nsw.gov.au

Please contact Elizabeth Currey (M,T,W) on (02) 4920 5067 and contact Kirstyn Goulding (Th,F) on (02) 4920 5058 for any inquiries

9 Attachment B – Proposed Dredging Area

JOHNSON PROCTER SURVEYORS PTY LIMITED

ABN 99 030 462 878

Land, Engineering & Subdivision Development Surveying Consultants

2 KEFT AVENUE NOWRA, PO BOX 2031 BOMADERRY NSW 2541

PHONE: (02) 4423 3566 MOBILE: 0408 487 201

FAX: (02) 4423 1641 E-MAIL: jps@jpsurveyors.com.au

PLAN OF SEA GRASS LOCATION AND LEVEL SPOT HEIGHTS WITHIN THE SHOALHAVEN RIVER FOR SHOALHAVEN SAND PTY. LTD.

DATE : 16 OCTOBER, 2018

DATUM : SEE NOTES

LEVEL ORIGIN : SEE NOTES

REDUCTION RATIO : 1 : 2000 (A1) 1 : 4000 (A3)

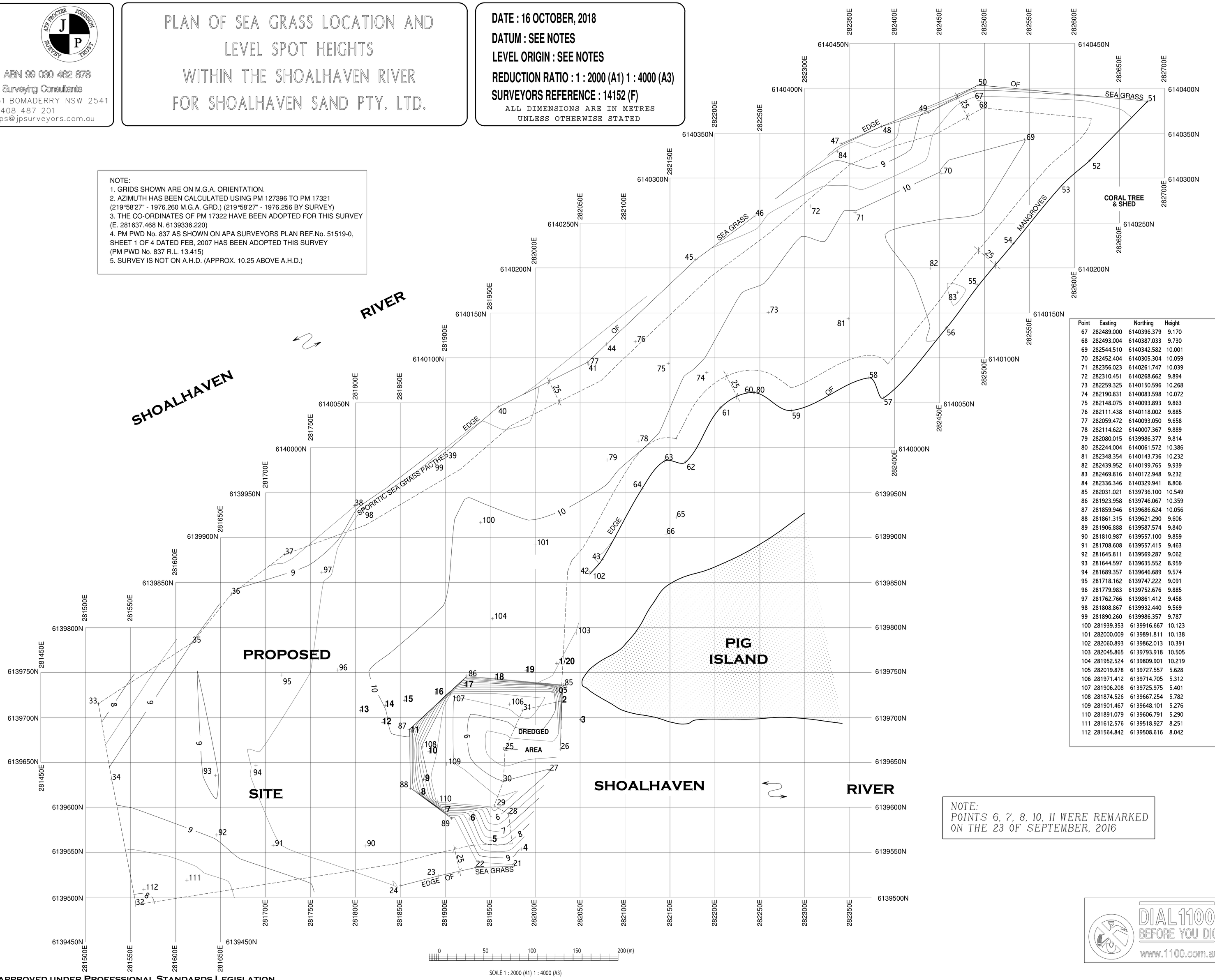
SURVEYORS REFERENCE : 14152 (F)

ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE STATED

NOTE:
1. GRIDS SHOWN ARE ON M.G.A. ORIENTATION.
2. AZIMUTH HAS BEEN CALCULATED USING PM 127396 TO PM 17321 (219°58'27" - 1976.260 M.G.A. GRD.) (219°58'27" - 1976.256 BY SURVEY)
3. THE CO-ORDINATES OF PM 17322 HAVE BEEN ADOPTED FOR THIS SURVEY (E. 281637.468 N. 6139336.220)
4. PM PWD No. 837 AS SHOWN ON APA SURVEYORS PLAN REF.No. 51519-0, SHEET 1 OF 4 DATED FEB, 2007 HAS BEEN ADOPTED THIS SURVEY (PM PWD No. 837 R.L. 13.415)
5. SURVEY IS NOT ON A.H.D. (APPROX. 10.25 ABOVE A.H.D.)

Point	Easting	Northing	Height
1	282024.232	6139760.149	10.436
2	282028.679	6139718.220	10.420
3	282050.704	6139697.679	10.300
4	281985.081	6139553.548	9.253
5	281950.932	6139563.353	9.936
6	281926.621	6139586.862	9.645
7	281900.124	6139599.419	9.793
8	281871.624	6139615.912	9.757
9	281875.961	6139631.082	9.739
10	281882.122	6139661.720	9.778
11	281862.220	6139684.682	9.825
12	281830.737	6139694.118	9.763
13	281805.905	6139707.552	9.668
14	281833.850	6139713.504	9.714
15	281855.056	6139719.037	9.803
16	281888.847	6139727.207	9.863
17	281922.171	6139735.289	9.975
18	281956.128	6139743.681	10.263
19	281990.130	6139751.874	10.398
20	282024.230	6139760.162	10.485
21	281975.380	6139534.420	9.649
22	281933.694	6139532.928	9.935
23	281892.274	6139523.607	9.849
24	281850.608	6139512.844	9.543
25	281966.541	6139664.598	7.050
26	282028.205	6139664.808	6.835
27	282015.982	6139640.792	5.940
28	281970.436	6139592.728	3.559
29	281954.336	6139601.546	5.178
30	281964.260	6139628.895	5.992
31	281986.361	6139708.250	5.165
32	281555.505	6139491.319	7.880
33	281514.090	6139715.389	7.578
34	281529.085	6139630.549	9.293
35	281618.564	6139783.138	9.011
36	281662.160	6139837.370	9.140
37	281721.409	6139881.341	8.235
38	281798.906	6139935.613	8.483
39	281902.058	6139996.365	9.772
40	281958.930	6140045.475	9.373
41	282058.472	6140095.149	9.831
42	282060.881	6139859.681	10.476
43	282074.487	6139875.617	10.548
44	282079.375	6140115.411	9.732
45	282178.735	6140209.236	9.542
46	282244.595	6140257.968	9.383
47	282340.335	6140338.144	7.738
48	282385.202	6140357.495	7.998
49	282437.587	6140372.854	9.201
50	282492.711	6140403.626	7.846
51	282681.318	6140385.449	9.362
52	282616.767	6140319.392	9.865
53	282585.990	6140292.132	9.901
54	282531.897	6140227.082	9.953
55	282491.653	6140181.318	9.881
56	282457.736	6140133.691	9.952
57	282387.248	6140055.357	10.209
58	282371.303	6140077.799	10.132
59	282285.370	6140041.585	10.263
60	282243.016	6140061.386	10.397
61	282206.279	6140044.625	10.324
62	282167.569	6139984.290	10.267
63	282143.630	6139985.216	10.296
64	282119.215	6139955.098	10.369
65	282157.118	6139922.802	11.215
66	282145.673	6139903.966	11.074

Point	Easting	Northing	Height
67	282489.000	6140396.379	9.170
68	282493.004	6140387.033	9.730
69	282544.510	6140342.582	10.001
70	282452.404	6140305.304	10.059
71	282356.023	6140261.747	10.039
72	282310.451	6140268.662	9.894
73	282259.325	6140150.596	10.268
74	282190.831	6140083.598	10.072
75	282148.075	6140093.893	9.863
76	282111.438	6140118.002	9.885
77	282059.472	6140093.050	9.658
78	282114.622	6140007.367	9.889
79	282080.015	6139986.377	9.814
80	282244.004	6140061.572	10.386
81	282348.354	6140143.736	10.232
82	282439.952	6140199.765	9.939
83	282469.816	6140172.948	9.232
84	282336.346	6140329.941	8.806
85	282031.021	6139736.100	10.549
86	281923.958	6139746.067	10.359
87	281859.946	6139686.624	10.056
88	281861.315	6139621.290	9.606
89	281906.888	6139587.574	9.840
90	281810.987	6139557.100	9.859
91	281708.608	6139557.415	9.463
92	281645.811	6139569.287	9.062
93	281644.597	6139635.552	8.959
94	281689.357	6139646.689	9.574
95	281718.162	6139747.222	9.091
96	281779.983	6139752.676	9.885
97	281762.766	6139861.412	9.458
98	281808.867	6139932.440	9.569
99	281890.260	6139986.357	9.787
100	281939.353	6139916.667	10.123
101	282000.009	6139891.811	10.138
102	282060.893	6139862.013	10.391
103	282045.865	6139793.918	10.505
104	281952.524	6139809.901	10.219
105	282019.878	6139727.557	5.628
106	281971.412	6139714.705	5.312
107	281906.208	6139725.975	5.401
108	281874.526	6139667.254	5.782
109	281901.467	6139648.101	5.276
110	281891.079	6139606.791	5.290
111	281612.576	6139518.927	8.251
112	281564.842	6139508.616	8.042



NOTE:
POINTS 6, 7, 8, 10, 11 WERE REMARKED ON THE 23 OF SEPTEMBER, 2016

DIAL 1100 BEFORE YOU DIG www.1100.com.au

11 Attachment C – Vibracore Testing Locations and Borehole Logs

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
C	**MINOR AMENDMENT**	**30/04/2019**	**RK**	**DOS**	**DOS**	**BM**
B	MINOR AMENDMENT	7/11/18	EM		DOS	BM
A	INITIAL RELEASE	15/10/2018	LZ			

SCALE
0 20 40 60 80 100 120 140 160 180 200 METRES
A1 (A3) 1:2,000 (1:4,000)

GRID	DATUM	PROJECT MANAGER
MGA	mAHD	SN

DISCLAIMER & COPYRIGHT
This plan must not be used for construction unless signed as approved by principal certifying authority.
All measurements in millimetres unless otherwise specified.

CLIENT
TERARA SHOALHAVEN SAND

PROJECT NAME/PLANSET TITLE
EXPANSION OF SAND EXTRACTION
CONTAMINATION ASSESSMENT
125 TERARA ROAD, TERARA NSW 2541

martens & Associates Pty Ltd
Consulting Engineers
Environment
Water
Geotechnical
Civil
Suite 201, 20 George St, Hornsby, NSW 2077 Australia Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au Internet: www.martens.com.au

DRAWING TITLE
EXTENT OF SAND DREDGING OPERATIONS

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1806743	PS01	R03	PS01-AZ00	C

PRINTED: 10.10.2018 - USER: RKOLAHDOOZHA
A1 / A3 LANDSCAPE (A1LC__v02.0.01)
DRAWING ID: P1806743-PS01-R03-AZ00

CLIENT	Terara Shoalhaven Sand Pty Ltd		COMMENCED	18/09/2018	COMPLETED	18/09/2018	**REF VC301**
PROJECT	Land Resource and Contamination Assessment		LOGGED	AM	CHECKED	BM	Sheet 1 OF 1
SITE	Shoalhaven River (Pig Island), NSW		GEOLOGY	Quaternary Deposits	VEGETATION	N/A	PROJECT NO. P1806743
EQUIPMENT		Vibrocore	EASTING		RL SURFACE	-0.3 m	DATUM AHD
EXCAVATION DIMENSIONS		ø80 mm x 3.10 m depth	NORTHING		ASPECT	West	SLOPE <2%

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VC	L	Drilled Over Water	0.5	-0.30	6743/VC301/0.0-0.5/S/1 D 0.00 m 6743/VC301/0.1-0.4/S/1 D 0.10 m 6743/VC301/0.2-1.0/S/1 D 0.20 m			SP	SAND, medium grained; brown-grey; trace wood.			ALLUVIUM
			1.0									
					6743/VC301/1.3-1.5/S/1 D 1.30 m					W		
			1.5	*1.80*								
	M			-2.10	6743/VC301/1.8-2.0/S/1 D 1.80 m 6743/VC301/1.9-2.2/S/1 D 1.90 m				Medium to coarse grained; grey; trace clay and wood fragments.			
			2.0									
			2.5	*2.70*								
	H			-3.00	6743/VC301/2.7-3.0/S/1 D 2.70 m 6743/VC301/2.7-3.1/S/1 D 2.70 m			SM	Silty SAND; medium to coarse grained; dark grey; with clay and wood.			2.70: to 3.1m; Partial core recovery.
			3.0	*3.10*					Hole Terminated at 3.10 m			3.10: Terminated due to high penetration resistance from wood fragments.
			3.5									
			4.0									
			4.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

MARTENS & ASSOCIATES PTY LTD
Suite 201, 20 George St. Hornsby, NSW 2077 Australia
Phone: (02) 9476 9999 Fax: (02) 9476 8767
mail@martens.com.au WEB: http://www.martens.com.au

Engineering Log - TEST

CLIENT	Terara Shoalhaven Sand Pty Ltd		COMMENCED	18/09/2018	COMPLETED	18/09/2018	**REF VC302A**
PROJECT	Land Resource and Contamination Assessment		LOGGED	AM	CHECKED	BM	Sheet 1 OF 1
SITE	Shoalhaven River (Pig Island), NSW		GEOLOGY	Quaternary Deposits	VEGETATION	N/A	PROJECT NO. P1806743
EQUIPMENT		Vibrocore	EASTING		RL SURFACE	0.1 m	DATUM AHD
EXCAVATION DIMENSIONS		ø80 mm x 1.60 m depth	NORTHING		ASPECT	West	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
				0.10	6743/VC302A/0.0-0.4/S/1 D 0.00 m 6743/VC302A/0.0-0.5/S/1 D 0.00 m			SP	SAND; medium grained; brown-grey.			ALLUVIUM
			0.5		6743/VC302A/0.6-0.9/S/1 D 0.60 m							
VC	L-M	Drilled Over Water		*0.90*						W		
			1.0	-0.80	6743/VC302A/0.9-1.2/S/1 D 0.90 m				Grey.			
					6743/VC302A/1.1-1.6/S/1 D 1.10 m 6743/VC302A/1.2-1.6/S/1 D 1.20 m							
			1.5									
	H			*1.60*					Hole Terminated at 1.60 m			1.60: Terminated due to high penetration resistance from wood fragments.
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

MARTENS & ASSOCIATES PTY LTD
Suite 201, 20 George St. Hornsby, NSW 2077 Australia
Phone: (02) 9476 9999 Fax: (02) 9476 8767
mail@martens.com.au WEB: http://www.martens.com.au

Engineering Log - TEST

martens

CLIENT	Terara Shoalhaven Sand Pty Ltd	COMMENCED	18/09/2018	COMPLETED	18/09/2018	**REF VC302B**
PROJECT	Land Resource and Contamination Assessment	LOGGED	AM	CHECKED	BM	Sheet 1 OF 1
SITE	Shoalhaven River (Pig Island), NSW	GEOLOGY	Quaternary Deposits	VEGETATION	N/A	PROJECT NO. P1806743
EQUIPMENT	Vibrocore	EASTING		RL SURFACE	0.1 m	DATUM AHD
EXCAVATION DIMENSIONS	ø80 mm x 3.40 m depth	NORTHING		ASPECT	West	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
VC		Drilled Over Water	0.5	0.10	6743/VC302B/0.0-0.3/S/1 D 0.00 m			SP	SAND; medium grained; brown-grey.			ALLUVIUM
	L-M		1.0		6743/VC302B/0.6-0.9/S/1 D 0.60 m							
			1.5		6743/VC302B/1.2-1.6/S/1 D 1.20 m							
				1.60 -1.50	6743/VC302B/1.6-2.0/S/1 D 1.60 m				From 1.6-1.8m: wood.	W		
	M		2.0		6743/VC302B/2.0-2.4/S/1 D 2.00 m							
			2.5									
	H		3.0		6743/VC302B/2.8-3.0/S/1 D 2.80 m 6743/VC302B/2.8-3.4/S/1 D 2.80 m							
			3.5	*3.40*					Hole Terminated at 3.40 m			3.40: Terminated due to high penetration resistance.
			4.0									
			4.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

MARTENS & ASSOCIATES PTY LTD
Suite 201, 20 George St. Hornsby, NSW 2077 Australia
Phone: (02) 9476 9999 Fax: (02) 9476 8767
mail@martens.com.au WEB: http://www.martens.com.au

Engineering Log - TEST

martens

CLIENT	Terara Shoalhaven Sand Pty Ltd	COMMENCED	18/09/2018	COMPLETED	18/09/2018	**REF VC303**
PROJECT	Land Resource and Contamination Assessment	LOGGED	AM	CHECKED	BM	Sheet 1 OF 1
SITE	Shoalhaven River (Pig Island), NSW	GEOLOGY	Quaternary Deposits	VEGETATION	N/A	PROJECT NO. P1806743
EQUIPMENT	Vibrocore	EASTING		RL SURFACE	-0.7 m	DATUM AHD
EXCAVATION DIMENSIONS	ø80 mm x 3.00 m depth	NORTHING		ASPECT	West	SLOPE <2%

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
				-0.70	6743/VC303/0.0-0.5/S/1 D 0.00 m 6743/VC303/0.0-0.5/S/2 D 0.00 m			SP	SAND; fine to medium grained; brown-grey.			ALLUVIUM
			0.5	*0.50* -1.20	6743/VC303/0.5-0.8/S/1 D 0.50 m 6743/VC303/0.5-0.8/S/2 D 0.50 m			ML	Clayey SILT; low plasticity; dark grey.			
				0.80 -1.50				SP	SAND; medium to coarse grained; brown-grey.			
	L		1.0		6743/VC303/0.9-1.3/S/1 D 0.90 m 6743/VC303/0.9-1.3/S/2 D 0.90 m							
VC		Drilled Over Water	1.5		6743/VC303/1.5-2.1/S/1 D 1.50 m					W		
			2.0	*2.00* -2.70					Trace subangular, fine grained, lithic gravel.			
	M-H		2.5									
	H		3.0	*3.00*	6743/VC303/2.7-3.0/S/1 D 2.70 m 6743/VC303/2.7-3.0/S/2 D 2.70 m				Hole Terminated at 3.00 m			3.00: Terminated due to high penetration resistance.
			3.5									
			4.0									
			4.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

MARTENS & ASSOCIATES PTY LTD
Suite 201, 20 George St. Hornsby, NSW 2077 Australia
Phone: (02) 9476 9999 Fax: (02) 9476 8767
mail@martens.com.au WEB: http://www.martens.com.au

Engineering Log - TEST

martens

CLIENT	Terara Shoalhaven Sand Pty Ltd	COMMENCED	18/09/2018	COMPLETED	18/09/2018	**REF VC304A**
PROJECT	Land Resource and Contamination Assessment	LOGGED	AM	CHECKED	BM	Sheet 1 OF 1
SITE	Shoalhaven River (Pig Island), NSW	GEOLOGY	Quaternary Deposits	VEGETATION	N/A	PROJECT NO. P1806743
EQUIPMENT	Vibrocore	EASTING		RL SURFACE	-0.2 m	DATUM AHD
EXCAVATION DIMENSIONS	ø80 mm x 3.40 m depth	NORTHING		ASPECT	West	SLOPE <2%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
				-0.20	6743/VC304A/0.0-0.2/S/1 D 0.00 m 6743/VC304A/0.0-0.2/S/2 D 0.00 m			SP	SAND; fine to medium grained; brown-grey; trace silt.			ALLUVIUM
				0.20 -0.40				SP	SAND; fine to medium grained, brown-grey.			
VC	L	Drilled Over Water	0.5		6743/VC304A/0.4-0.6/S/1 D 0.40 m 6743/VC304A/0.4-0.6/S/2 D 0.40 m							
				0.90 -1.10					Trace wood.			
			1.0		6743/VC304A/1.0-1.2/S/1 D 1.00 m							
	L-M		1.5							W		
			2.0		6743/VC304A/1.8-2.0/S/1 D 1.80 m							
					6743/VC304A/2.1-2.5/S/1 D 2.10 m							
	M		2.5		6743/VC304A/2.5-2.7/S/1 D 2.50 m							
				2.90 -3.10				ML	Sandy SILT; low plasticity; dark grey; with wood.			
	H		3.0		6743/VC304A/3.0-3.2/S/1 D 3.00 m							
					6743/VC304A/3.2-3.4/S/1 D 3.20 m							
			3.5	*3.40*					Hole Terminated at 3.40 m			3.40: Terminated due to high penetration resistance from wood fragments.
			4.0									
			4.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

MARTENS & ASSOCIATES PTY LTD
Suite 201, 20 George St. Hornsby, NSW 2077 Australia
Phone: (02) 9476 9999 Fax: (02) 9476 8767
mail@martens.com.au WEB: http://www.martens.com.au

Engineering Log - TEST

martens

CLIENT	Terara Shoalhaven Sand Pty Ltd	COMMENCED	18/09/2018	COMPLETED	18/09/2018	**REF VC304B**
PROJECT	Land Resource and Contamination Assessment	LOGGED	AM	CHECKED	BM	Sheet 1 OF 1
SITE	Shoalhaven River (Pig Island), NSW	GEOLOGY	Quaternary Deposits	VEGETATION	N/A	PROJECT NO. P1806743
EQUIPMENT	Vibrocore	EASTING		RL SURFACE	-0.2 m	DATUM AHD
EXCAVATION DIMENSIONS	ø80 mm x 3.70 m depth	NORTHING		ASPECT	West	SLOPE <2%

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
				-0.20	6743/VC304B/0.0-0.3/S/1 D 0.00 m			SP	SAND, fine to medium grained; brown-grey.			ALLUVIUM
			0.5	*0.50* -0.70					Trace wood.			
	L-M				6743/VC304B/0.7-1.0/S/1 D 0.70 m							
			1.0		6743/VC304B/1.0-1.5/S/1 D 1.00 m							
			1.5		6743/VC304B/1.5-1.7/S/1 D 1.50 m							
VC		Drilled Over Water								W		
			2.0		6743/VC304B/2.2-2.5/S/1 D 2.20 m							
	M		2.5									
			3.0									
				3.20 -3.40	6743/VC304B/3..2-3.4/S/1 D 3.20 m			SM	Silty SAND; fine to medium grained; brown-grey.			3.20: to 3.7m: Partial core loss.
	H		3.5		6743/VC304B/3.2-3.7/S/1 D 3.20 m 6743/VC304B/3.4-3.7/S/1 D 3.40 m							
				3.70					Hole Terminated at 3.70 m			3.70: Terminated due to high penetration resistance.
			4.0									
			4.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

MARTENS & ASSOCIATES PTY LTD
Suite 201, 20 George St. Hornsby, NSW 2077 Australia
Phone: (02) 9476 9999 Fax: (02) 9476 8767
mail@martens.com.au WEB: http://www.martens.com.au

Engineering Log - TEST

martens

12 Attachment D – Data Validation Report

Contamination Assessment:
Proposed Expansion of Sand Dredging Operations
Terara Shoalhaven Sands, Pig Island, Terara, NSW
P1806743JR03V01 November 2018

Field Duplicates (SOIL)
Filter: SDG in('ENVIR(

SDG	ENVIROLAB 2018-09-20T00:00:00	ENVIROLAB 2018-09-20T00:00:00		ENVIROLAB 2018-09-20T00:00:00	ENVIROLAB 2018-09-20T00:00:00	
Field ID	6743/VC301/	Duplicate 1	**RPD**	6743/VC302A/	Duplicate 2	**RPD**
Sampled Date/Time	18/09/2018	18/09/2018		18/09/2018	18/09/2018	
Chem_Gr	**ChemNam**	**Units**	**EQL**						
Inorganics	Moisture	%	0.1	**16.0**	**22.0**	**32**	19.0	17.0	11
Lead	Lead	mg/kg	1	5.0	6.0	18	5.0	5.0	0
Metals	Arsenic	mg/kg	4	<4.0	5.0	22	<4.0	<4.0	0
	Cadmium	mg/kg	0.4	<0.4	<0.4	0	<0.4	<0.4	0
	Chromium	mg/kg	1	7.0	7.0	0	8.0	8.0	0
	Copper	mg/kg	1	3.0	4.0	29	3.0	3.0	0
	Mercury	mg/kg	0.1	<0.1	<0.1	0	<0.1	<0.1	0
	Nickel	mg/kg	1	9.0	9.0	0	10.0	10.0	0
	Zinc	mg/kg	1	26.0	29.0	11	28.0	28.0	0

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 80 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Contents

Field Duplicates

SOIL Field Duplicates (SOIL)
Filter: SDG in('ENVIROLAB 201

SDG	ENVIROLAB 2018-09-20T00:00:00	Eurofins	
Field ID	6743/VC302A/	Triplicate 1	**RPD**
Sampled Date/Time	18/09/2018	18/09/2018	

Filter	Chem_Group	ChemNam	Units	EQL			
Inorganics	Inorganics	Moisture	%	0.1	19.0	16	17
Inorganics							
Lead	Lead	Lead	mg/kg	1	5.0	5	0
Lead							
Metals	Metals	Arsenic	mg/kg	4	<4.0	<4.0	0
Metals		Cadmium	mg/kg	0.4	<0.4	<0.4	0
Metals		Chromium	mg/kg	1	8.0	<5	0
Metals		Copper	mg/kg	1	3.0	<5	0
Metals		Mercury	mg/kg	0.1	<0.1	<0.1	0
Metals		Nickel	mg/kg	1	10.0	5.7	55
Metals		Zinc	mg/kg	1	28.0	18	44

*RPDs have only been considered where a concentration is greater than 1 times the EQL.

**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 80 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL))

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in

DATA VALIDATION REPORT: Contamination Assessment: Proposed Expansion of Sand Dredging Operations, Terara Sands, Pig Island, Nowra, NSW

1. Sample Handling

	Yes	No (Comments below)
a. Were sample holding times met?	✓	
b. Were samples in proper custody between the field and reaching the laboratory?	✓	
c. Were the samples properly and adequately preserved?	✓	
d. Were the samples received by the laboratory in good condition?	✓	

COMMENTS

Sample handling is:

✓ **Satisfactory**

Partially Satisfactory

Unsatisfactory

2. Precision / Accuracy Statement

	Yes	No (Comments below)
a. Was a NATA registered laboratory used?	✓	
b. Did the laboratory perform the requested tests?	✓	
c. Were laboratory methods adopted NATA endorsed?	✓	
d. Were appropriate test procedures followed?	✓	
e. Were reporting limits satisfactory?	✓	
f. Was the NATA Seal on the reports?	✓	
g. Were reports signed by an authorised person?	✓	

COMMENTS

Precision / Accuracy of the Laboratory Report:	✓	**Satisfactory**
		Partially Satisfactory
		Unsatisfactory

3. Field Quality Assurance / Quality Control (QA/QC)

	Media	Number
a. Number of Primary Samples analysed *(does not include duplicates)*	Soil:	16
	Water:	-
	Material	1
b. Number of days of sampling	1	

c. Number and Type of QA/QC Samples analysed	Soil	Water
Intra-Laboratory Field Duplicates	3	
Inter-Laboratory Field triplicates	1	
Trip Blanks	1	
Field Rinsate	-	
Other (Field Blanks, Spikes, etc.)	-	

Comments

Trip spike and blank used.

Field Duplicates

	Yes	No (Comments below)
Adequate Numbers of intra-laboratory field duplicates analysed?	✓	
Adequate Numbers of inter-laboratory field duplicates analysed?	✓	-
Were field duplicate RPDs within Control Limits?		
i. Organics		N/A
ii. Metals / Inorganics	✓	
iii. Nutrients		N/A

COMMENTS

Summary of Quality Assurance / Quality Control (QA/QC)

QA/QC Type	Satisfactory	Partially Satisfactory	Unsatisfactory
Sample handling	✓		
Precision / Accuracy of the Laboratory Report	✓		
Field QA / QC	✓		
Laboratory Internal QA / QC	✓		

Data Usability

1. Data directly usable ✓

2. Data usable with the following corrections/modifications
   (see comment below)

3. Data not usable.

COMMENTS

13 Attachment E – Laboratory Summary Tables

	PFAS	Metals							
	PFAS	Lead	Arsenic	Cadmium	Chromium (III+VI)	Copper	Mercury	Nickel	Zinc
	µg/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		1	4	0.4	1	1	0.1	1	1
Interim sediment quality guidelines (ISQG - Low) - ANZECC		**50**	**20**	**1.5**	**80**	**65**	**0.15**	**21**	**200**
NEPM 2013 Table 1A(1) HILs Res A Soil		**300**	**100**	**20**		**6000**	**40**	**400**	**7400**
PFAS National Environment Management Plan	**0.7**								
Field_ID									
6743/VC301/0.1 - 0.4	<0.1	5	<4	<0.4	7	3	<0.1	9	26
6743/VC301/2.7 - 3.0	-	11	14	<0.4	10	8	<0.1	15	43
6743/VC302A/0 - 0.5	<0.1	5	<4	<0.4	8	3	<0.1	10	28
6743/VC302A/0.9 - 1.2	<0.1	7	<4	<0.4	9	5	<0.1	12	33
6743/VC302B/0 - 0.3	-	4	<4	<0.4	8	3	<0.1	10	27
6743/VC302B/1.6 - 2.0	-	4	<4	<0.4	8	4	<0.1	10	27
6743/VC303/0 - 0.5	<0.1	-	-	-	-	-	-	-	-
6743/VC303/0.5 - 0.8	<0.1	12	7	<0.4	12	12	<0.1	13	45
6743/VC303/0.9 - 1.3	<0.1	4	<4	<0.4	6	2	<0.1	8	23
6743/VC304A/0.4 - 0.6	-	7	<4	<0.4	9	4	<0.1	11	33
6743/VC304A/3.2 - 3.4	-	9	83	<0.4	9	9	<0.1	**34**	48
6743/VC304B/0.4 - 0.6	-	5	<4	<0.4	9	4	<0.1	10	30
6743/VC304B/3.2 - 3.4	-	5	<4	<0.4	8	3	<0.1	10	28
Duplicate 1	-	6	5	<0.4	7	4	<0.1	9	29
Duplicate 2	-	5	<4	<0.4	8	3	<0.1	10	28
Trip Spike	-	-	-	-	-	-	-	-	-
Trip Blank	-	-	-	-	-	-	-	-	-

	Organochlorine Pesticides																				Organophosphorous Pesticides											Pesticides
	4,4-DDE	a-BHC	Aldrin	b-BHC	Chlordane (cis)	Chlordane (trans)	d-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor	Azinophos methyl	Bromophos-ethyl	Chlorpyrifos	Chlorpyrifos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Ronnel	Parathion
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Interim sediment quality guidelines (ISQG - Low) - ANZECC	**2.2**				**0.5**			**2**	**1.6**		**0.02**				**0.02**		**0.32**															
NEPM 2013 Table 1A(1) HILs Res A Soil										**240**					**10**			**6**		**300**			**160**									
Field_ID																																
6743/VC301/0.1 - 0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6743/VC301/2.7 - 3.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6743/VC302A/0 - 0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6743/VC302A/0.9 - 1.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6743/VC302B/0 - 0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6743/VC302B/1.6 - 2.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6743/VC303/0 - 0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6743/VC303/0.5 - 0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6743/VC303/0.9 - 1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6743/VC304A/0.4 - 0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6743/VC304A/3.2 - 3.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6743/VC304B/0.4 - 0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
6743/VC304B/3.2 - 3.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Duplicate 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Duplicate 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trip Spike	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trip Blank	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Contamination Assessment:
Proposed Expansion of Sand Dredging Operations at Terara Shoalhaven Sand, Pig Island, Terara NSW.

	PAHs					BTEX							Halogenated Benzenes	PAH/Phenols														TPH								
	Benzo(a)pyrene TEQ (LOR)	Benzo(b+j+k)fluoranthene	Total Positive PAHs	Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ calc (Zero)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10 less BTEX (F1)	Hexachlorobenzene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Carcinogenic PAHs (as B(a)P TPE, PEFs-3)	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	C10-C16	C16-C34	C34-C40	F2-NAPHTHALENE	C6 - C9	C10 - C14	C15 - C28	C29-C36	C10 - C40 (Sum of total)	C6-C10
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.5	0.2	0.05	0.5	0.5	0.2	1	0.5	2	1	1	25	0.1	0.1	0.1	0.1	0.1	0.05	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	50	100	100	50	25	50	100	100	50	25
Interim sediment quality guidelines (ISQG - Low) - ANZECC			**4000**											**16**	**44**	**85**	**261**	**430**		**384**	**63**	**600**					**240**	**665**										
NEPM 2013 Table 1A(1) HILs Res A Soil													**10**																								
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																																				
0-1m						**0.5**	**55**	**160**			**40**	**45**															**3**					**110**						
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil																																				
0-2m						**50**	**70**	**85**			**105**							**0.7**												**120**	**300**	**2800**							**180**
PFAS National Environment Management Plan																																						
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																													**1000**	**3500**	**10000**							**800**
Field_ID																																						
6743/VC301/0.1 - 0.4	<0.5	<0.2	<0.05	<0.5	<0.5	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
6743/VC301/2.7 - 3.0	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6743/VC302A/0 - 0.5	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6743/VC302A/0.9 - 1.2	<0.5	<0.2	<0.05	<0.5	<0.5	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
6743/VC302B/0 - 0.3	<0.5	<0.2	<0.05	<0.5	<0.5	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
6743/VC302B/1.6 - 2.0	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6743/VC303/0 - 0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6743/VC303/0.5 - 0.8	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6743/VC303/0.9 - 1.3	<0.5	<0.2	<0.05	<0.5	<0.5	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
6743/VC304A/0.4 - 0.6	<0.5	<0.2	<0.05	<0.5	<0.5	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
6743/VC304A/3.2 - 3.4	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6743/VC304B/0.4 - 0.6	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6743/VC304B/3.2 - 3.4	<0.5	<0.2	<0.05	<0.5	<0.5	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
Duplicate 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Duplicate 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trip Spike	-	-	-	-	-	95	83	90	97	98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trip Blank	-	-	-	-	-	<0.2	<1	<0.5	<2	<1	<1	<25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	<25	-	-	-	-	<25

14 Attachment F – 95% UCL Spreadsheet

Lognormal UCL Statistics for Uncensored Full Data Sets

User Selected Options	
Date/Time of Computation	ProUCL 5.13/10/2018 11:25:09 AM
From File	WorkSheet_a.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

C0

General Statistics

Total Number of Observations	12	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	8	Mean	12.67
Maximum	34	Median	10
SD	6.972	Std. Error of Mean	2.013
Coefficient of Variation	0.55	Skewness	3.049

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.726	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.242	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level	

Data appear Approximate Lognormal at 5% Significance Level

Logged Statistics

Minimum of Logged Data	2.079	Mean of logged Data	2.456
Maximum of Logged Data	3.526	SD of logged Data	0.376

Lognormal Maximum likelihood Estimates (MLEs)

MLE Mean	12.51	MLE Standard Deviation	4.869
MLE Median	11.66	MLE Skewness	1.227
MLE Coefficient of Variation	0.389	80% MLE Quantile	15.99
90% MLE Quantile	18.87	95% MLE Quantile	21.62
99% MLE Quantile	27.93		

Lognormal Minimum Variance Unbiased Estimates (MVUEs)

MVUE Mean	12.43	MVUE SD	4.738
MVUE Median	11.59	MVUE SEM	1.367

Assuming Lognormal Distribution

95% H-UCL	15.69	90% Chebyshev (MVUE) UCL	16.53
95% Chebyshev (MVUE) UCL	18.39	97.5% Chebyshev (MVUE) UCL	20.97
99% Chebyshev (MVUE) UCL	26.03		

Nonparametric Distribution Free UCLs

95% CLT UCL	15.98	95% Jackknife UCL	16.28
95% Standard Bootstrap UCL	15.92	95% Bootstrap-t UCL	25.32
95% Hall's Bootstrap UCL	29.24	95% Percentile Bootstrap UCL	16.25
95% BCA Bootstrap UCL	18		
90% Chebyshev(Mean, Sd) UCL	18.7	95% Chebyshev(Mean, Sd) UCL	21.44
97.5% Chebyshev(Mean, Sd) UCL	25.24	99% Chebyshev(Mean, Sd) UCL	32.69

Suggested UCL to Use

95% Student's-t UCL	16.28	or 95% Modified-t UCL	16.58
or 95% H-UCL	15.69		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.

H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.

It is therefore recommended to avoid the use of H-statistic based 95% UCLs.

Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

15 Attachment G – Laboratory Analytical Certificates

CHAIN OF CUSTODY FORM

	Laboratory Testing								
Project	Contaminatian Assessment: Terara Sands, Nawra								
Martens Contact Officer	Daniel O'Sullivan	**Contact Email**	dasullivan@martens.cam.au						
Sampling and Shipping	**Sample Date**	18/09/18	**Due Date**				Standard		
	Our Reference	**Shipping Method (x)**	**Hand**		**Post**			**Courier**	**X**
	On Ice (X)	**X**	**Olher (X)**						
	Laboratory								
Name	Enviralab Services Pty Ltd								
Sample Delivery Address	Labaratory								
Delivery Contact	**Name**	**Phone**	9476 9999	**Fax**		**Email**	dasullivan@martens.cam.au		
Please Send Report BY (X)	**Post**		**Email**	**x**		**Reporting Email Address**	dasullivan@martens.cam.au jfultan@martens.cam.au		

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

Job No: 201253

Date Received: 20/9/18
Time Received: 1615
Received By: JB
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

20/253

	Item	Sample ID	Combo 5b	Heavy Metals	OCP	OPP	AFFF Screen (PFOS/PFOA)	TRH	BTEX	Hold
1	1	6743/VC301/0.1 – 0.4	X				X			
2	2	6743/VC301/1.8 – 2.0								X
3	3	6743/VC301/2.7 – 3.0		X	X	X				
4	4	6743/VC302A/0 – 0.5		X	X	X	X			
5	5	6743/VC302A/0.9 – 1.2	X				X			
6	6	6743/VC302B/0 – 0.3	X							
7	7	6743/VC302B/1.6 – 2.0		X	X	X				
8	8	6743/VC303/0 – 0.5					X			
9	9	6743/VC303/0.5 – 0.8		X	X	X				
10	10	6743/VC303/0.9 – 1.3	X				X			
11	11	6743/VC303/2.7 – 3.0								X
12	12	6743/VC304A/0.4 – 0.6	X				X			
13	14	6743/VC304A/3.2 – 3.4		X	X	X				
14	15	6743/VC304B/0.4 – 0.6		X	X	X				
15	16	6743/VC304B/3.0 – 3.2	X							
	18									
16	26	Duplicate 1		X						
17	27	Duplicate 2		X						
~~18~~	28	Triplicate 1		X						
18	29	Trip Spike						X		
19	30	Trip Blank .							X	

****PLEASE SEND TRIPLICATE SAMPLE THROUGH TO EUROFINS

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 201253

Client Details

Client	Martens & Associates Pty Ltd
Attention	Jeff Fulton, Dan O'Sullivan
Address	Suite 201, 20 George St, Hornsby, NSW, 2077

Sample Details

Your Reference	**Contamination Assessment: Terara Sands, Nowra**
Number of Samples	19 Soil
Date samples received	20/09/2018
Date completed instructions received	20/09/2018

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	27/09/2018
Date of Issue	27/09/2018

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Hinoko Miyazaki, Customer Service
Long Pham, Team Leader, Metals
Phalak Inthakesone, Organics Development Manager, Sydney
Steven Luong, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		201253-1	201253-5	201253-6	201253-10	201253-12
Your Reference	UNITS	6743/VC301/	6743/VC302A/	6743/VC302B/	6743/VC303/	6743/VC304A/
Depth		0.1-0.4	0.9-1.2	0.0-0.3	0.9-1.3	0.4-0.6
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018	24/09/2018	24/09/2018
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	81	71	91	84	92

vTRH(C6-C10)/BTEXN in Soil				
Our Reference		201253-15	201253-18	201253-19
Your Reference	UNITS	6743/VC304B/	Trip Spike	Trip Blank
Depth		3.0-3.2	-	-
Date Sampled		18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil
Date extracted	-	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018
TRH C_6 - C_9	mg/kg	<25	[NA]	<25
TRH C_6 - C_{10}	mg/kg	<25	[NA]	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	[NA]	<25
Benzene	mg/kg	<0.2	95%	<0.2
Toluene	mg/kg	<0.5	90%	<0.5
Ethylbenzene	mg/kg	<1	83%	<1
m+p-xylene	mg/kg	<2	97%	<2
o-Xylene	mg/kg	<1	98%	<1
naphthalene	mg/kg	<1	[NA]	<1
Total +ve Xylenes	mg/kg	<1	[NA]	<1
Surrogate aaa-Trifluorotoluene	%	78	70	87

svTRH (C10-C40) in Soil						
Our Reference		201253-1	201253-5	201253-6	201253-10	201253-12
Your Reference	UNITS	6743/VC301/	6743/VC302A/	6743/VC302B/	6743/VC303/	6743/VC304A/
Depth		0.1-0.4	0.9-1.2	0.0-0.3	0.9-1.3	0.4-0.6
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	22/09/2018	22/09/2018	22/09/2018	22/09/2018	22/09/2018
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	70	71	73	71	72

svTRH (C10-C40) in Soil		
Our Reference		201253-15
Your Reference	UNITS	6743/VC304B/
Depth		3.0-3.2
Date Sampled		18/09/2018
Type of sample		Soil
Date extracted	-	21/09/2018
Date analysed	-	22/09/2018
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	<100
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	75

PAHs in Soil						
Our Reference		201253-1	201253-5	201253-6	201253-10	201253-12
Your Reference	UNITS	6743/VC301/	6743/VC302A/	6743/VC302B/	6743/VC303/	6743/VC304A/
Depth		0.1-0.4	0.9-1.2	0.0-0.3	0.9-1.3	0.4-0.6
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018	24/09/2018	24/09/2018
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	86	88	88	86	84

PAHs in Soil		
Our Reference		201253-15
Your Reference	UNITS	6743/VC304B/
Depth		3.0-3.2
Date Sampled		18/09/2018
Type of sample		Soil
Date extracted	-	21/09/2018
Date analysed	-	24/09/2018
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	<0.1
Pyrene	mg/kg	<0.1
Benzo(a)anthracene	mg/kg	<0.1
Chrysene	mg/kg	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Total +ve PAH's	mg/kg	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5
Surrogate p-Terphenyl-d14	%	89

Organochlorine Pesticides in soil						
Our Reference		201253-1	201253-3	201253-4	201253-5	201253-6
Your Reference	UNITS	6743/VC301/	6743/VC301/	6743/VC302A/	6743/VC302A/	6743/VC302B/
Depth		0.1-0.4	2.7-3.0	0.0-0.5	0.9-1.2	0.0-0.3
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018	24/09/2018	24/09/2018
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	95	99	85	88	86

Organochlorine Pesticides in soil						
Our Reference		201253-7	201253-9	201253-10	201253-12	201253-13
Your Reference	UNITS	6743/VC302B/	6743/VC303/	6743/VC303/	6743/VC304A/	6743/VC304A/
Depth		1.6-2.0	0.5-0.8	0.9-1.3	0.4-0.6	3.2-3.4
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018	24/09/2018	24/09/2018
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	85	88	89	89	91

Organochlorine Pesticides in soil			
Our Reference		201253-14	201253-15
Your Reference	UNITS	6743/VC304B/	6743/VC304B/
Depth		0.4-0.6	3.0-3.2
Date Sampled		18/09/2018	18/09/2018
Type of sample		Soil	Soil
Date extracted	-	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018
HCB	mg/kg	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1
Surrogate TCMX	%	92	90

Organophosphorus Pesticides						
Our Reference		201253-1	201253-3	201253-4	201253-5	201253-6
Your Reference	UNITS	6743/VC301/	6743/VC301/	6743/VC302A/	6743/VC302A/	6743/VC302B/
Depth		0.1-0.4	2.7-3.0	0.0-0.5	0.9-1.2	0.0-0.3
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018	24/09/2018	24/09/2018
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	95	99	85	88	86

Organophosphorus Pesticides						
Our Reference		201253-7	201253-9	201253-10	201253-12	201253-13
Your Reference	UNITS	6743/VC302B/	6743/VC303/	6743/VC303/	6743/VC304A/	6743/VC304A/
Depth		1.6-2.0	0.5-0.8	0.9-1.3	0.4-0.6	3.2-3.4
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018	24/09/2018	24/09/2018
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	85	89	89	89	91

Organophosphorus Pesticides			
Our Reference		201253-14	201253-15
Your Reference	UNITS	6743/VC304B/	6743/VC304B/
Depth		0.4-0.6	3.0-3.2
Date Sampled		18/09/2018	18/09/2018
Type of sample		Soil	Soil
Date extracted	-	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1
Surrogate TCMX	%	92	90

Acid Extractable metals in soil						
Our Reference		201253-1	201253-3	201253-4	201253-5	201253-6
Your Reference	UNITS	6743/VC301/	6743/VC301/	6743/VC302A/	6743/VC302A/	6743/VC302B/
Depth		0.1-0.4	2.7-3.0	0.0-0.5	0.9-1.2	0.0-0.3
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018	24/09/2018	24/09/2018
Arsenic	mg/kg	<4	14	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	7	10	8	9	8
Copper	mg/kg	3	8	3	5	3
Lead	mg/kg	5	11	5	7	4
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	9	15	10	12	10
Zinc	mg/kg	26	43	28	33	27

Acid Extractable metals in soil						
Our Reference		201253-7	201253-9	201253-10	201253-12	201253-13
Your Reference	UNITS	6743/VC302B/	6743/VC303/	6743/VC303/	6743/VC304A/	6743/VC304A/
Depth		1.6-2.0	0.5-0.8	0.9-1.3	0.4-0.6	3.2-3.4
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018	24/09/2018	24/09/2018
Arsenic	mg/kg	<4	7	<4	<4	83
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	8	12	6	9	9
Copper	mg/kg	4	12	2	4	9
Lead	mg/kg	4	12	4	7	9
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	10	13	8	11	34
Zinc	mg/kg	27	45	23	33	48

Acid Extractable metals in soil					
Our Reference		201253-14	201253-15	201253-16	201253-17
Your Reference	UNITS	6743/VC304B/	6743/VC304B/	Duplicate 1	Duplicate 2
Depth		0.4-0.6	3.0-3.2	-	-
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018	24/09/2018
Arsenic	mg/kg	<4	<4	5	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	9	8	7	8
Copper	mg/kg	4	3	4	3
Lead	mg/kg	5	5	6	5
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	10	10	9	10
Zinc	mg/kg	30	28	29	28

Moisture						
Our Reference		201253-1	201253-3	201253-4	201253-5	201253-6
Your Reference	UNITS	6743/VC301/	6743/VC301/	6743/VC302A/	6743/VC302A/	6743/VC302B/
Depth		0.1-0.4	2.7-3.0	0.0-0.5	0.9-1.2	0.0-0.3
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018	24/09/2018	24/09/2018
Moisture	%	16	34	19	24	19

Moisture						
Our Reference		201253-7	201253-8	201253-9	201253-10	201253-12
Your Reference	UNITS	6743/VC302B/	6743/VC303/	6743/VC303/	6743/VC303/	6743/VC304A/
Depth		1.6-2.0	0.0-0.5	0.5-0.8	0.9-1.3	0.4-0.6
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018	24/09/2018	24/09/2018
Moisture	%	18	15	28	13	18

Moisture						
Our Reference		201253-13	201253-14	201253-15	201253-16	201253-17
Your Reference	UNITS	6743/VC304A/	6743/VC304B/	6743/VC304B/	Duplicate 1	Duplicate 2
Depth		3.2-3.4	0.4-0.6	3.0-3.2	-	-
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	24/09/2018	24/09/2018	24/09/2018	24/09/2018	24/09/2018
Moisture	%	40	18	17	22	17

PFAs in Soils Short						
Our Reference		201253-1	201253-4	201253-5	201253-8	201253-10
Your Reference	UNITS	6743/VC301/	6743/VC302A/	6743/VC302A/	6743/VC303/	6743/VC303/
Depth		0.1-0.4	0.0-0.5	0.9-1.2	0.0-0.5	0.9-1.3
Date Sampled		18/09/2018	18/09/2018	18/09/2018	18/09/2018	18/09/2018
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Date analysed	-	21/09/2018	21/09/2018	21/09/2018	21/09/2018	21/09/2018
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
6:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
8:2 FTS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate $^{13}C_8$ *PFOS*	%	101	102	102	100	97
Surrogate $^{13}C_2$ *PFOA*	%	94	103	103	95	102
Extracted ISTD $^{18}O_2$ *PFHxS*	%	86	89	88	92	94
Extracted ISTD $^{13}C_4$ *PFOS*	%	88	90	87	86	90
Extracted ISTD $^{13}C_4$ *PFOA*	%	92	91	87	97	96
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	107	102	105	100	105
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	72	78	67	91	84
Total Positive PFHxS & PFOS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total Positive PFOS & PFOA	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total Positive PFAS	µg/kg	<0.1	<0.1	<0.1	<0.1	<0.1

PFAs in Soils Short		
Our Reference		201253-12
Your Reference	UNITS	6743/VC304A/
Depth		0.4-0.6
Date Sampled		18/09/2018
Type of sample		Soil
Date prepared	-	21/09/2018
Date analysed	-	21/09/2018
Perfluorohexanesulfonic acid - PFHxS	µg/kg	<0.1
Perfluorooctanesulfonic acid PFOS	µg/kg	<0.1
Perfluorooctanoic acid PFOA	µg/kg	<0.1
6:2 FTS	µg/kg	<0.1
8:2 FTS	µg/kg	<0.1
Surrogate $^{13}C_8$ *PFOS*	%	104
Surrogate $^{13}C_2$ *PFOA*	%	93
Extracted ISTD $^{18}O_2$ *PFHxS*	%	95
Extracted ISTD $^{13}C_4$ *PFOS*	%	90
Extracted ISTD $^{13}C_4$ *PFOA*	%	97
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	102
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	84
Total Positive PFHxS & PFOS	µg/kg	<0.1
Total Positive PFOS & PFOA	µg/kg	<0.1
Total Positive PFAS	µg/kg	<0.1

Method ID	Methodology Summary
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.

Method ID	Methodology Summary
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.
Org-035	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.1 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.
Org-035_2	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.1 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	201253-5
Date extracted	-			21/09/2018	1	21/09/2018	21/09/2018		21/09/2018	21/09/2018
Date analysed	-			24/09/2018	1	24/09/2018	24/09/2018		24/09/2018	24/09/2018
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	87	90
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	87	90
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	84	84
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	78	89
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	99	90
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	88	93
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	97	91
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	80	1	81	78	4	78	80

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	15	21/09/2018	21/09/2018		[NT]	[NT]
Date analysed	-			[NT]	15	24/09/2018	24/09/2018		[NT]	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	[NT]	15	<25	<25	0	[NT]	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	[NT]	15	<25	<25	0	[NT]	[NT]
Benzene	mg/kg	0.2	Org-016	[NT]	15	<0.2	<0.2	0	[NT]	[NT]
Toluene	mg/kg	0.5	Org-016	[NT]	15	<0.5	<0.5	0	[NT]	[NT]
Ethylbenzene	mg/kg	1	Org-016	[NT]	15	<1	<1	0	[NT]	[NT]
m+p-xylene	mg/kg	2	Org-016	[NT]	15	<2	<2	0	[NT]	[NT]
o-Xylene	mg/kg	1	Org-016	[NT]	15	<1	<1	0	[NT]	[NT]
naphthalene	mg/kg	1	Org-014	[NT]	15	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	[NT]	15	78	93	18	[NT]	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	201253-5
Date extracted	-			21/09/2018	1	21/09/2018	21/09/2018		21/09/2018	21/09/2018
Date analysed	-			22/09/2018	1	22/09/2018	22/09/2018		22/09/2018	22/09/2018
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	111	117
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	98	101
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	<100	<100	0	75	84
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	111	117
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	1	<100	<100	0	98	101
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	1	<100	<100	0	75	84
Surrogate o-Terphenyl	%		Org-003	75	1	70	70	0	78	71

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	15	21/09/2018	21/09/2018		[NT]	[NT]
Date analysed	-			[NT]	15	22/09/2018	22/09/2018		[NT]	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	[NT]	15	<50	<50	0	[NT]	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	[NT]	15	<100	<100	0	[NT]	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	[NT]	15	<100	<100	0	[NT]	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	[NT]	15	<50	<50	0	[NT]	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	[NT]	15	<100	<100	0	[NT]	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	[NT]	15	<100	<100	0	[NT]	[NT]
Surrogate o-Terphenyl	%		Org-003	[NT]	15	75	78	4	[NT]	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	201253-5
Date extracted	-			21/09/2018	1	21/09/2018	21/09/2018		21/09/2018	21/09/2018
Date analysed	-			24/09/2018	1	24/09/2018	24/09/2018		24/09/2018	24/09/2018
Naphthalene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	108	69
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	104	62
Phenanthrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	114	76
Anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	108	72
Pyrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	100	67
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	105	71
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	1	<0.05	<0.05	0	105	70
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	89	1	86	85	1	92	64

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	15	21/09/2018	21/09/2018		[NT]	[NT]
Date analysed	-			[NT]	15	24/09/2018	24/09/2018		[NT]	[NT]
Naphthalene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Phenanthrene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Anthracene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Pyrene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	[NT]	15	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	[NT]	15	<0.05	<0.05	0	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	[NT]	15	89	85	5	[NT]	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	201253-5
Date extracted	-			21/09/2018	1	21/09/2018	21/09/2018		21/09/2018	21/09/2018
Date analysed	-			24/09/2018	1	24/09/2018	24/09/2018		24/09/2018	24/09/2018
HCB	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	93	97
gamma-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	76	77
Heptachlor	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	88	86
delta-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	86	88
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	87	88
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	88	90
Dieldrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	91	93
Endrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	97	97
pp-DDD	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	91	93
Endosulfan II	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	71	72
Methoxychlor	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	89	1	95	94	1	105	106

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	15	21/09/2018	21/09/2018		[NT]	[NT]
Date analysed	-			[NT]	15	24/09/2018	24/09/2018		[NT]	[NT]
HCB	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
gamma-BHC	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
delta-BHC	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
gamma-Chlordane	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Dieldrin	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Endrin	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Endosulfan II	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Methoxychlor	mg/kg	0.1	Org-005	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	[NT]	15	90	93	3	[NT]	[NT]

QUALITY CONTROL: Organophosphorus Pesticides						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	201253-5
Date extracted	-			21/09/2018	1	21/09/2018	21/09/2018		21/09/2018	[NT]
Date analysed	-			24/09/2018	1	24/09/2018	24/09/2018		24/09/2018	24/09/2018
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	86	66
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	77	90
Dimethoate	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	99	80
Fenitrothion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	119	82
Malathion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	70	66
Parathion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	106	106
Ronnel	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	92	[NT]
Surrogate TCMX	%		Org-008	89	1	95	94	1	86	86

QUALITY CONTROL: Organophosphorus Pesticides						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	15	21/09/2018	21/09/2018		[NT]	[NT]
Date analysed	-			[NT]	15	24/09/2018	24/09/2018		[NT]	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-008	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-008	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-008	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-008	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Dimethoate	mg/kg	0.1	Org-008	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-008	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Fenitrothion	mg/kg	0.1	Org-008	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Malathion	mg/kg	0.1	Org-008	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Parathion	mg/kg	0.1	Org-008	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-008	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-008	[NT]	15	90	93	3	[NT]	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	201253-5
Date prepared	-			21/09/2018	1	21/09/2018	21/09/2018		21/09/2018	21/09/2018
Date analysed	-			24/09/2018	1	24/09/2018	24/09/2018		24/09/2018	24/09/2018
Arsenic	mg/kg	4	Metals-020	<4	1	<4	<4	0	111	99
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	104	102
Chromium	mg/kg	1	Metals-020	<1	1	7	7	0	107	103
Copper	mg/kg	1	Metals-020	<1	1	3	3	0	108	130
Lead	mg/kg	1	Metals-020	<1	1	5	4	22	111	104
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	121	111
Nickel	mg/kg	1	Metals-020	<1	1	9	9	0	111	108
Zinc	mg/kg	1	Metals-020	<1	1	26	25	4	111	99

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	15	21/09/2018	21/09/2018		[NT]	[NT]
Date analysed	-			[NT]	15	24/09/2018	24/09/2018		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	15	<4	<4	0	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	15	<0.4	<0.4	0	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	15	8	8	0	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	15	3	3	0	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	15	5	4	22	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	15	<0.1	<0.1	0	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	15	10	10	0	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	15	28	28	0	[NT]	[NT]

QUALITY CONTROL: PFAs in Soils Short						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			21/09/2018	1	21/09/2018	21/09/2018		21/09/2018	[NT]
Date analysed	-			21/09/2018	1	21/09/2018	21/09/2018		21/09/2018	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/kg	0.1	Org-035	<0.1	1	<0.1	<0.1	0	119	[NT]
Perfluorooctanesulfonic acid PFOS	µg/kg	0.1	Org-035	<0.1	1	<0.1	<0.1	0	107	[NT]
Perfluorooctanoic acid PFOA	µg/kg	0.1	Org-035	<0.1	1	<0.1	<0.1	0	96	[NT]
6:2 FTS	µg/kg	0.1	Org-035	<0.1	1	<0.1	<0.1	0	93	[NT]
8:2 FTS	µg/kg	0.1	Org-035	<0.1	1	<0.1	<0.1	0	107	[NT]
Surrogate $^{13}C_8$ *PFOS*	%		Org-035	97	1	101	103	2	103	[NT]
Surrogate $^{13}C_2$ *PFOA*	%		Org-035_2	101	1	94	99	5	92	[NT]
Extracted ISTD $^{18}O_2$ *PFHxS*	%		Org-035	96	1	86	89	3	94	[NT]
Extracted ISTD $^{13}C_4$ *PFOS*	%		Org-035	101	1	88	90	2	98	[NT]
Extracted ISTD $^{13}C_4$ *PFOA*	%		Org-035	105	1	92	96	4	110	[NT]
Extracted ISTD $^{13}C_2$ *6:2FTS*	%		Org-035	112	1	107	97	10	113	[NT]
Extracted ISTD $^{13}C_2$ *8:2FTS*	%		Org-035	92	1	72	86	18	92	[NT]

Result Definitions

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

20/253

	Item	Sample ID	Combo 5b	Heavy Metals	OCP	OPP	AFFF Screen (PFOS/PFOA)	TRH	BTEX	Hold
1	1	6743/VC301/0.1 – 0.4	x				x			
2	2	6743/VC301/1.8 – 2.0								x
3	3	6743/VC301/2.7 – 3.0		x	x	x				
4	4	6743/VC302A/0 – 0.5		x	x	x	x			
5	5	6743/VC302A/0.9 – 1.2 (302 (kev))	x				x			
6	6	6743/VC302B/0 – 0.3	x							
7	7	6743/VC302B/1.6 – 2.0 (302 (kev))		x	x	x				
8	8	6743/VC303/0 – 0.5					x			
9	9	6743/VC303/0.5 – 0.8		x	x	x				
10	10	6743/VC303/0.9 – 1.3	x				x			
11	11	6743/VC303/2.7 – 3.0								x
12	12	6743/VC304A/0.4 – 0.6	x				x			
13	14	6743/VC304A/3.2 – 3.4		x	x	x				
14	15	6743/VC304B/0.4 – 0.6	0–0.2/2 (kev)	x	x	x				
15	16	6743/VC304B/3.0 – 3.2	0–0.3 (kev) x							
	18									
16	26	Duplicate 1		x						
17	27	Duplicate 2		x						
~~#18~~ (kev)	28	Triplicate 1		x						
18	29	Trip Spike						x		
19	30	Trip Blank							x	

****PLEASE SEND TRIPLICATE SAMPLE THROUGH TO EUROFINS

Relinquished: Kate Gore ELS

21/9/18 11:50

RCVD: RJTIMRBA 21/9 ~~[illegible]~~

#61914

CHAIN OF CUSTODY FORM

#619141

	Laboratory Testing								
Project	Contamination Assessment: Terara Sands, Nowra								
Martens Contact Officer	Daniel O'Sullivan	**Contact Email**	dosullivan@martens.com.au						
Sampling and Shipping	**Sample Date**	18/09/18	**Due Date**			Standard			
	Our Reference	**Shipping Method (X)**	**Hand**		**Post**		**Courier**	X	
	On Ice (X)	X	**Other (X)**						
	Laboratory								
Name	Envirolab Services Pty Ltd								
Sample Delivery Address	Laboratory								
Delivery Contact	**Name**	**Phone**	9476 9999	**Fax**		**Email**	dosullivan@martens.com.au		
Please Send Report BY (X)	**Post**		**Email**	X		**Reporting Email Address**	dosullivan@martens.com.au jfulton@martens.com.au		

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

Job No: 201253

Date Received: 20/9/18
Time Received: 16:15
Received By: [illegible]
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

eurofins | mgt

30 years Testing For Life 1987–2017
Celebrating 30 years Testing and Protecting Human Health

Certificate of Analysis

Martens & Associates Pty Ltd
Suite 201, 20 George St
Hornsby
NSW 2077

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Daniel O'Sullivan**

Report **619141-S**
Project name CONTAMINATION ASSESSMENT: TERARA SANDS NOWRA
Received Date Sep 21, 2018

Client Sample ID			**TRIPLICATE 1**
Sample Matrix			**Soil**
Eurofins | mgt Sample No.			**S18-Se30796**
Date Sampled			**Sep 18, 2018**
Test/Reference	LOR	Unit	
Heavy Metals			
Arsenic	2	mg/kg	< 2
Cadmium	0.4	mg/kg	< 0.4
Chromium	5	mg/kg	< 5
Copper	5	mg/kg	< 5
Lead	5	mg/kg	< 5
Mercury	0.1	mg/kg	< 0.1
Nickel	5	mg/kg	5.7
Zinc	5	mg/kg	18
% Moisture	1	%	16

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Metals M8	Sydney	Sep 24, 2018	28 Day
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
% Moisture	Sydney	Sep 24, 2018	14 Day
- Method: LTM-GEN-7080 Moisture			

ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Company Name:	Martens & Associates Pty Ltd	**Order No.:**		**Received:**	Sep 21, 2018 3:06 PM
Address:	Suite 201, 20 George St Hornsby NSW 2077	**Report #:**	619141	**Due:**	Sep 28, 2018
		Phone:	02 9476 9999	**Priority:**	5 Day
		Fax:	02 9476 8767	**Contact Name:**	Daniel O'Sullivan
Project Name:	CONTAMINATION ASSESSMENT: TERARA SANDS NOWRA				

Eurofins | mgt Analytical Services Manager : Andrew Black

Sample Detail						Metals M8	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271							
Sydney Laboratory - NATA Site # 18217						X	X
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	TRIPLICATE 1	Sep 18, 2018		Soil	S18-Se30796	X	X
Test Counts						1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	Quality Systems Manual ver 5.1 US Department of Defense
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	97			70-130	Pass	
Cadmium	%	96			70-130	Pass	
Chromium	%	103			70-130	Pass	
Copper	%	104			70-130	Pass	
Lead	%	104			70-130	Pass	
Mercury	%	100			70-130	Pass	
Nickel	%	104			70-130	Pass	
Zinc	%	104			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S18-Se31107	NCP	%	93			70-130	Pass	
Cadmium	S18-Se31107	NCP	%	92			70-130	Pass	
Chromium	S18-Se31107	NCP	%	112			70-130	Pass	
Copper	S18-Se31107	NCP	%	101			70-130	Pass	
Lead	S18-Se31107	NCP	%	104			70-130	Pass	
Mercury	S18-Se31107	NCP	%	99			70-130	Pass	
Nickel	S18-Se31107	NCP	%	99			70-130	Pass	
Zinc	S18-Se31107	NCP	%	107			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S18-Se31598	NCP	mg/kg	< 2	< 2	<1	30%	Pass	
Cadmium	S18-Se31598	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	S18-Se31598	NCP	mg/kg	7.0	8.0	13	30%	Pass	
Copper	S18-Se31598	NCP	mg/kg	5.8	6.9	18	30%	Pass	
Lead	S18-Se31598	NCP	mg/kg	9.2	9.7	5.0	30%	Pass	
Mercury	S18-Se31598	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	S18-Se31598	NCP	mg/kg	10	9.8	2.0	30%	Pass	
Zinc	S18-Se31598	NCP	mg/kg	23	25	10	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	S18-Se30796	CP	%	16	17	2.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Andrew Black Analytical Services Manager

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.