

Annex C

## Baseline Water Quality Study 2016

26 August 2016

AWE Taranaki Limited  
8<sup>th</sup> Floor, Transfield Worley House  
25-33 Gill Street  
NEW PLYMOUTH 4243  
NEW ZEALAND

Our Reference: 0361311\_AWE NEW PLYMOUTH\_D

Attention: Simon Knapman

Dear Simon,

**RE: AWE NEW PLYMOUTH - SEAWATER SAMPLING**

ERM New Zealand Limited (ERM) was engaged by AWE Taranaki Limited (AWE) to conduct seawater sampling from the offshore Tui field, Taranaki, New Zealand.

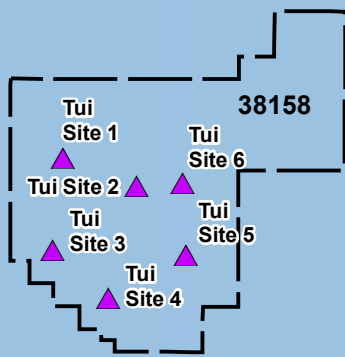
All samples were taken from within PMP38158, at a distance of at least three nautical miles from the location of the Floating Production, Storage and Offtake (FPSO) vessel "Umuroa".

This letter summarises the analytical results for seawater samples collected on 08 August 2016.



**METHOD**

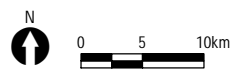
Six (6) samples (Tui Site 1 - Tui Site 6) were collected from a depth of 10 metres using a 2-Litre van Dorn horizontal sampler. Site locations are shown in *Figure 1* and the latitude and longitude for each site is listed in *Table 1*.

SITE NAME	LATITUDE	LONGITUDE
Tui Site 1	39° 22.364' S	173° 11.058' E
Tui Site 2	39° 23.613' S	173° 15.248' E
Tui Site 3	39° 26.451' S	173° 10.481' E
Tui Site 4	39° 28.550' S	173° 13.653' E
Tui Site 5	39° 26.626' S	173° 18.056' E
Tui Site 6	39° 23.475' S	173° 17.830' E



Legend

-  Tui PMP 38158
-  Water Quality Sampling Locations



Client:	AWE Taranaki Limited	
Drawing No:	0361311s_G001_R0.mxd	
Date:	25/08/2016	Drawing Size: A4
Drawn By:	GC	Reviewed By: AL

**Figure 1 - Water Quality Sampling Locations in PMP 38158 – August 2016**

Project Title  
 Environmental Resources Management ANZ  
 Auckland, Brisbane, Canberra, Christchurch,  
 Melbourne, Newcastle, Perth, Port Macquarie, Sydney



This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

The sampler was rinsed thoroughly with clean seawater between sites and allowed to sit at the target depth for two minutes prior to triggering at each site. Samples were immediately decanted into laboratory supplied glassware and kept chilled prior to being shipped to RJ Hill (Hill's) laboratory for analysis.

## SEAWATER ANALYSIS

All seawater samples were submitted under chain of custody to Hill's Laboratories for analysis for total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbon (PAH) compounds, including naphthalene, pyrene, and benzo(a)pyrene (BaP). Samples were additionally tested for Total Suspended Solids (TSS), Total Arsenic, Total Cadmium, Total Chromium, Total Copper, Total Lead, Total Nickel, Total Zinc and Non-Purgeable Organic Carbon (NPOC).

## RESULTS

All seawater sample analytical results have been compared to the Australian and New Zealand Environmental and Conservation Council (ANZECC) Guidelines for Water Quality for 95% level of protection for marine species (ANZECC 2000).

Non-Purgeable Organic Carbon was detected at low levels in all samples. Total Copper was also detected at low levels (0.0013 g/m<sup>3</sup>) in Tui Site 6. All results complied with the adopted ANZECC Guidelines.

Full results are shown in Attachment A.

All other samples presented results below the lab detection limits.

Yours sincerely,  
for ERM New Zealand Ltd



Alison Lane  
Technical Director



## ANALYSIS REPORT

<b>Client:</b>	ERM	<b>Lab No:</b>	1628664	SPV1
<b>Contact:</b>	Alison Lane C/- ERM PO Box 25 Taranaki Mail Centre New Plymouth 4340	<b>Date Received:</b>	10-Aug-2016	
		<b>Date Reported:</b>	19-Aug-2016	
		<b>Quote No:</b>	79112	
		<b>Order No:</b>	0364193	
		<b>Client Reference:</b>	Seawater	
		<b>Submitted By:</b>	Alison Lane	

### Sample Type: Saline

Sample Name:		Tui Site 1	Tui Site 2	Tui Site 3	Tui Site 4	Tui Site 5
Lab Number:		08-Aug-2016	08-Aug-2016	08-Aug-2016	08-Aug-2016	08-Aug-2016
		1628664.1	1628664.2	1628664.3	1628664.4	1628664.5
Individual Tests						
Total Suspended Solids	g/m <sup>3</sup>	< 3	< 3	< 3	< 3	< 3
Total Arsenic	g/m <sup>3</sup>	< 0.0042	< 0.0042	< 0.0042	< 0.0042	< 0.0042
Total Cadmium	g/m <sup>3</sup>	< 0.00021	< 0.00021	< 0.00021	< 0.00021	< 0.00021
Total Chromium	g/m <sup>3</sup>	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Total Copper	g/m <sup>3</sup>	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Total Lead	g/m <sup>3</sup>	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Total Nickel	g/m <sup>3</sup>	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
Total Zinc	g/m <sup>3</sup>	< 0.0042	< 0.0042	< 0.0042	< 0.0042	< 0.0042
Non-Purgeable Organic Carbon (NPOC)	g/m <sup>3</sup>	2.1	1.2	1.2	2.0	1.1
Polycyclic Aromatic Hydrocarbons Trace in Water, By Liq/Liq						
Acenaphthene	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Acenaphthylene	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Anthracene	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Benzo[a]anthracene	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Benzo[a]pyrene (BAP)	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Benzo[b]fluoranthene + Benzo[j]fluoranthene	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Benzo[g,h,i]perylene	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Benzo[k]fluoranthene	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Chrysene	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Dibenzo[a,h]anthracene	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Fluoranthene	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Fluorene	g/m <sup>3</sup>	< 0.000008	< 0.000010	< 0.000010	< 0.000008	< 0.000008
Indeno(1,2,3-c,d)pyrene	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Naphthalene	g/m <sup>3</sup>	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00004
Phenanthrene	g/m <sup>3</sup>	< 0.000008	< 0.000010	< 0.000010	< 0.000008	< 0.000008
Pyrene	g/m <sup>3</sup>	< 0.000008	< 0.000008	< 0.000008	< 0.000008	< 0.000008
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m <sup>3</sup>	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
C10 - C14	g/m <sup>3</sup>	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36	g/m <sup>3</sup>	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m <sup>3</sup>	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

Sample Type: Saline						
<b>Sample Name:</b>	Tui Site 6 08-Aug-2016					
<b>Lab Number:</b>	1628664.6					
Individual Tests						
Total Suspended Solids	g/m <sup>3</sup>	< 3	-	-	-	-
Total Arsenic	g/m <sup>3</sup>	< 0.0042	-	-	-	-
Total Cadmium	g/m <sup>3</sup>	< 0.00021	-	-	-	-
Total Chromium	g/m <sup>3</sup>	< 0.0011	-	-	-	-
Total Copper	g/m <sup>3</sup>	0.0013	-	-	-	-
Total Lead	g/m <sup>3</sup>	< 0.0011	-	-	-	-
Total Nickel	g/m <sup>3</sup>	< 0.007	-	-	-	-
Total Zinc	g/m <sup>3</sup>	< 0.0042	-	-	-	-
Non-Purgeable Organic Carbon (NPOC)	g/m <sup>3</sup>	1.0	-	-	-	-
Polycyclic Aromatic Hydrocarbons Trace in Water, By Liq/Liq						
Acenaphthene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Acenaphthylene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Anthracene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Benzo[a]anthracene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Benzo[a]pyrene (BAP)	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Benzo[b]fluoranthene + Benzo[j]fluoranthene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Benzo[g,h,i]perylene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Benzo[k]fluoranthene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Chrysene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Dibenzo[a,h]anthracene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Fluoranthene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Fluorene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Indeno(1,2,3-c,d)pyrene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Naphthalene	g/m <sup>3</sup>	< 0.00004	-	-	-	-
Phenanthrene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Pyrene	g/m <sup>3</sup>	< 0.000008	-	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m <sup>3</sup>	< 0.10	-	-	-	-
C10 - C14	g/m <sup>3</sup>	< 0.2	-	-	-	-
C15 - C36	g/m <sup>3</sup>	< 0.4	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m <sup>3</sup>	< 0.7	-	-	-	-

### Analyst's Comments

Appendix No.1 - Chain of Custody

## SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Saline			
Test	Method Description	Default Detection Limit	Sample No
Polycyclic Aromatic Hydrocarbons Trace in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS SIM analysis [KBIs:4736,2695]	0.000005 g/m <sup>3</sup>	1-6
Total Petroleum Hydrocarbons in Water	Hexane extraction, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734]	0.10 - 0.7 g/m <sup>3</sup>	1-6
Total Digestion of Saline Samples	Nitric acid digestion. APHA 3030 E 22 <sup>nd</sup> ed. 2012 (modified).	-	1-6
Total Suspended Solids	Saline sample. Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 22 <sup>nd</sup> ed. 2012.	3 g/m <sup>3</sup>	1-6
Total Arsenic	Nitric acid digestion, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0042 g/m <sup>3</sup>	1-6
Total Cadmium	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.00021 g/m <sup>3</sup>	1-6
Total Chromium	Nitric acid digestion, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0011 g/m <sup>3</sup>	1-6
Total Copper	Nitric acid digestion, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0011 g/m <sup>3</sup>	1-6

Sample Type: Saline			
Test	Method Description	Default Detection Limit	Sample No
Total Lead	Nitric acid digestion, ICP-MS, ultratrace level. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0011 g/m <sup>3</sup>	1-6
Total Nickel	Nitric acid digestion, ICP-MS with universal cell, ultratrace. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0011 g/m <sup>3</sup>	1-6
Total Zinc	Nitric acid digestion, ICP-MS with dynamic reaction cell, ultratrace. APHA 3125 B 22 <sup>nd</sup> ed. 2012.	0.0042 g/m <sup>3</sup>	1-6
Non-Purgeable Organic Carbon (NPOC)	Acidification, purging to remove inorganic C, super-critical persulphate oxidation at 375°C, IR detection. APHA 5310 C (modified) 22 <sup>nd</sup> ed. 2012.	0.3 g/m <sup>3</sup>	1-6

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This report must not be reproduced, except in full, without the written consent of the signatory.



Ara Heron BSc (Tech)  
Client Services Manager - Environmental



**ANALYSIS** Job No: Date Recv: 10-Aug-16 05:46  
**162 8664**  
 R J Hill Laboratories Ltd  
 1 Clyde Street,  
 Private Bag 3205,  
 Hamilton 3240, NEW ZEALAND  
 Received by: Lisa Bailey

Office use Job I  
 3116286644

**Client**  
 Name ERM 112093  
 Address PO Box 106234, Auckland City  
Auckland 1143  
 Phone 09 303 4664 Fax 09 303 3254  
 Client Reference \_\_\_\_\_  
 Quote No 79112 Order No \_\_\_\_\_  
**Primary Contact** H Lee 205402  
**Submitted By** H Lee 205402  
**Charge To** ERM 112093  
**Results To**  Mail Primary Contact  Mail Submitter  
 Fax Results \_\_\_\_\_  
 Email Results \_\_\_\_\_

**CHAIN OF CUSTODY RECORD**

**Sent to Hill Laboratories** Date & Time: 9 Aug 16 a.m.  
 Please tick if you require COC to be emailed back  
 Name: Alison Lanez  
 Signature: \_\_\_\_\_  
**Received at Hill Laboratories** Date & Time: 10.8.16 1028  
 Name: Karl [Signature]  
 Signature: \_\_\_\_\_  
**Condition** Temp: \_\_\_\_\_  
 Room Temp  Chilled  Frozen 4.9  
 Sample & Analysis details checked  
 Signature: \_\_\_\_\_

**Priority**  Low  Normal  High  
 Urgent (ASAP, extra charge applies, please contact lab first)  
 NOTE: The estimated turnaround time for the types and number of samples and analyses specified on this quote is by 4:30 pm, 5 working days following the day of receipt of the samples at the laboratory.

**ADDITIONAL INFORMATION**

**Quoted Sample Types** Requested Reporting Date: 19.8.16  
 Saline (Sal)

No.	Sample Name	Sample Date/Time	Sample Type	Tests Required
1	Tui Site 1	8.8.16/pm	Saline	5 bottles - as per quote 79112
2	Tui Site 2	"	"	"
3	Tui Site 3	"	"	"
4	Tui Site 4	"	"	"
5	Tui Site 5	"	"	"
6	Tui Site 6	"	"	"
7				
8				
9				
10				