

APPENDIX 2
WATER SAMPLE ANALYSES



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17025
Accreditation No 2013

Certificate of Analysis



**BUREAU
VERITAS**

Petrofrontier Pty Ltd
Level 12, 115 Grenfell Street
Adelaide SA 5000
Australia

Attention: Merridy McLeod

Project Name 11PEAD0084504
Collected by Client
Client Ref: 6180100829

Customer Sample ID		Baldwin-2	Baldwin-2	Baldwin-2
Description		160m Sample 1	385m Sample 2	450m Sample 3
Date Received		of 5	of 5	of 5
Sample Type		22/11/2011	22/11/2011	22/11/2011
WATER ANALYSIS		Water	Water	Water
Test/Reference	Unit			
PROPERTIES: APHA 4500-H+ A,B				
pH at Measured Temp.		8.1	7.7	7.9
Measured Temp.	°C	22.5	21.9	22.7
PROPERTIES: APHA 2510 A,B				
Electrical Conductivity @ 25°C	µS/cm	700	1700	1100
Resistivity @ 25°C	M.Ohm	14.29	5.88	9.09
ANIONS mg/L APHA 2320 A,B				
Hydroxide as CaCO ₃	mg/L	<1	<1	<1
Carbonate as CaCO ₃	mg/L	<1	<1	<1
Bicarbonate as CaCO ₃	mg/L	270	220	250
ANIONS mg/L APHA 4110				
Chloride as Cl	mg/L	40	110	120
Nitrate as NO ₃	mg/L	9	3	<0.1
Sulphate as SO ₄	mg/L	44	770	210
Total Anions	mg/L	93	880	330
ANIONS meq/L APHA 1050 A				
Hydroxide as OH*	meq/L	<0.01	<0.01	<0.01
Carbonate as CO ₃ *	meq/L	<0.01	<0.01	<0.01
Bicarbonate as HCO ₃ *	meq/L	5	4	5
Chloride as Cl*	meq/L	1	3	3
Nitrate as NO ₃ *	meq/L	0.14	0.05	<0.01
Sulphate as SO ₄ *	meq/L	0.92	16	4
Total Anions*	meq/L	2	19	8
CATIONS mg/L APHA 3120				
Potassium as K	mg/L	6	13	8
Sodium as Na	mg/L	29	82	87
Barium as Ba	mg/L	0.11	<0.1	<0.1
Calcium as Ca	mg/L	37	160	73
Iron as Fe	mg/L	<0.1	<0.1	0.11
Magnesium as Mg	mg/L	57	87	53
Strontium as Sr	mg/L	10	16	2
Aluminium as Al	mg/L	<0.1	<0.1	<0.1
Total Cations	mg/L	140	360	220
CATIONS meq/L APHA 1050 A				
Potassium as K*	meq/L	0.16	0.35	0.20



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Customer Sample ID		Baldwin-2	Baldwin-2	Baldwin-2
Description		160m Sample 1	385m Sample 2	450m Sample 3
Date Received		of 5	of 5	of 5
Sample Type		22/11/2011	22/11/2011	22/11/2011
Sample Type		Water	Water	Water
WATER ANALYSIS				
Test/Reference	Unit			
Sodium as Na*	meq/L	1	4	4
Barium as Ba*	meq/L	<0.01	<0.01	<0.01
Calcium as Ca*	meq/L	2	8	4
Iron as Fe*	meq/L	<0.01	<0.01	<0.01
Magnesium as Mg*	meq/L	5	7	4
Strontium as Sr*	meq/L	0.23	0.35	0.04
Aluminium as Al*	meq/L	<0.01	<0.01	<0.01
Total Cations*	meq/L	8	19	12
DERIVED PARAMETERS APHA 4110 & 3120				
Ion balance (Diff * 100/Sum)	%	58	1	22
Acceptance Criteria	%	5	5	5
Satisfactory		No	Yes	No
DERIVED PARAMETERS APHA 2320 A,B				
Total Alkalinity (calc as CaCO ₃)	mg/L	270	220	250
DERIVED PARAMETERS APHA 4110 & 3120				
Total Cations + Anions	mg/L	230	1200	550
DERIVED PARAMETERS APHA 2340 B				
Hardness (calc as CaCO ₃)	mg/L	330	750	400
DERIVED PARAMETERS APHA 2540 A,B,C,D				
Calculated Total Dissolved Solids	mg/L	450	1100	700

Customer Sample ID		Baldwin-2	Baldwin-2
Description		566m Sample 4	625m Sample 5
Date Received		of 5	of 5
Sample Type		22/11/2011	22/11/2011
Sample Type		Water	Water
WATER ANALYSIS			
Test/Reference	Unit		
PROPERTIES: APHA 4500-H+ A,B			
pH at Measured Temp.		7.8	7.5
Measured Temp.	°C	22.5	22.1
PROPERTIES: APHA 2510 A,B			
Electrical Conductivity @ 25°C	µS/cm	1100	1300
Resistivity @ 25°C	M.Ohm	9.09	7.69
ANIONS mg/L APHA 2320 A,B			
Hydroxide as CaCO ₃	mg/L	<1	<1
Carbonate as CaCO ₃	mg/L	<1	<1
Bicarbonate as CaCO ₃	mg/L	230	240
ANIONS mg/L APHA 4110			
Chloride as Cl	mg/L	120	160
Nitrate as NO ₃	mg/L	<0.1	1
Sulphate as SO ₄	mg/L	230	260
Total Anions	mg/L	350	420
ANIONS meq/L APHA 1050 A			
Hydroxide as OH*	meq/L	<0.01	<0.01

**BUREAU
VERITAS**

Customer Sample ID		Baldwin-2	Baldwin-2
Description		566m Sample 4	625m Sample 5
Date Received		of 5	of 5
Sample Type		22/11/2011	22/11/2011
Water Analysis		Water	Water
Test/Reference	Unit		
Carbonate as CO ₃ *	meq/L	<0.01	<0.01
Bicarbonate as HCO ₃ *	meq/L	5	5
Chloride as Cl*	meq/L	3	4
Nitrate as NO ₃ *	meq/L	<0.01	0.02
Sulphate as SO ₄ *	meq/L	5	5
Total Anions*	meq/L	8	10
CATIONS mg/L APHA 3120			
Potassium as K	mg/L	8	11
Sodium as Na	mg/L	89	120
Barium as Ba	mg/L	<0.1	<0.1
Calcium as Ca	mg/L	77	95
Iron as Fe	mg/L	<0.1	<0.1
Magnesium as Mg	mg/L	55	45
Strontium as Sr	mg/L	2	3
Aluminium as Al	mg/L	<0.1	<0.1
Total Cations	mg/L	230	270
CATIONS meq/L APHA 1050 A			
Potassium as K*	meq/L	0.20	0.29
Sodium as Na*	meq/L	4	5
Barium as Ba*	meq/L	<0.01	<0.01
Calcium as Ca*	meq/L	4	5
Iron as Fe*	meq/L	<0.01	<0.01
Magnesium as Mg*	meq/L	5	4
Strontium as Sr*	meq/L	0.05	0.06
Aluminium as Al*	meq/L	<0.01	<0.01
Total Cations*	meq/L	12	14
DERIVED PARAMETERS APHA 4110 & 3120			
Ion balance (Diff * 100/Sum)	%	21	17
Acceptance Criteria	%	5	5
Satisfactory		No	No
DERIVED PARAMETERS APHA 2320 A,B			
Total Alkalinity (calc as CaCO ₃)	mg/L	230	240
DERIVED PARAMETERS APHA 4110 & 3120			
Total Cations + Anions	mg/L	580	690
DERIVED PARAMETERS APHA 2340 B			
Hardness (calc as CaCO ₃)	mg/L	420	420
DERIVED PARAMETERS APHA 2540 A,B,C,D			
Calculated Total Dissolved Solids	mg/L	700	800
Test Description			
DERIVED PARAMETERS		If the ion balance in this sample is unsatisfactory it is most likely due to a component or components of the sample that is not within the scope of this analysis.	

Authorised By

Valentina Pavlovic

Chemist

Accreditation No 2013

Laboratory Manager

James Dennett

Operations Coordinator



Final Report

- Indicates Not Requested

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

Samples will be discarded after 30 days unless otherwise notified.

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The samples were not collected by Laboratory staff.



APG WS CHINCHILLA LABORATORY

(Report No. S2011-033)

WATER ANALYSIS REPORT

Client:
Petro Frontier

Field: TBA

REQUESTED BY:
Craig Vandenberg (Stimulation Domain Manager)

PREPARED BY: Roshan/Sean/Affandi **REVIEWED BY: Ekaterina** (WPS GFE)

Date: 4th July 2011
Well: TBA
Test: Water Analysis

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1. Summary

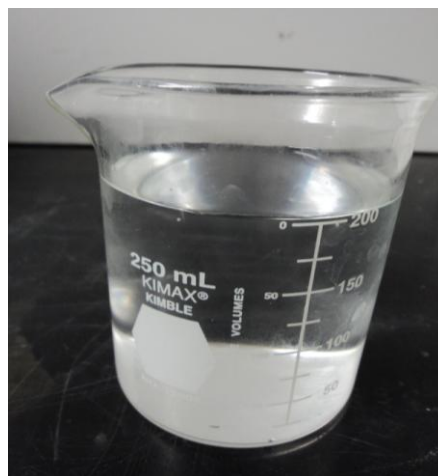
A water sample from a Petro Frontier water source was collected to check the quality of water to be used for mixing and pumping the recommended fracturing fluids.

2. Water Analysis

Sample 1: Petro Frontier

Quantity: 5 liter bottle

Source: TBA



Test/Elements	Results	Tolerance Range (YF100LG)
Temperature °F	65 °F	40 – 100 °F
Color	Clear	No Specification
pH	7.7	6 – 8
Specific Gravity, SG	1.000	1.000
Total Hardness	440.0 mg/L	No Specification
Ca ²⁺	280.0 mg/L	No Specification
Mg ²⁺	160.0 mg/L	< 50 mg/L *
Fe ²⁺	0.0 mg/L	< 8 mg/L **
Alkalinity	500 mg/L	< 450 mg/L *
Cl ⁻	1500.0 mg/L	< 30,000 mg/L
So ₄ ⁻	55.0 mg/L	

*would require M003/J494 adjustment based on lab test, see FMM for baseline

** would require J450 adjustment based on lab test, see FMM for baseline

Conclusions / Recommendations:

- a. The water sample from Petro Frontier had the values of Magnesium and Alkalinity "outside" the specified range for the YF100LG fluid application.
- b. The water samples from all sources must be treated with HCl on site to bring the pH down to the recommended range. The final concentration of HCl required for each water source must be determined by titrating with concentrated HCl in the lab on-site and the quality of the fluid confirmed by gelling up the water sample and checking the viscosity. As well, the concentration of iron Fe⁺ content must be closely watched as high contents would be detrimental to the stability of the fluid. Mixing gel samples and checking the gel loading after mixing and thereafter after 12 and 24 hours would confirm the same.
- c. The water quality was good overall with only Mg and alkalinity out of spec. If the pH is adjusted to the specified range for the fracturing fluid, the high alkalinity should not be an issue. As well, the formulation of the crosslinker solution could be adjusted to counter the high magnitude of Mg species.