FAIRBORNE ENERGY LTD.

October 14, 2009

Jennifer Abel
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Petroleum Branch
Box 1359- 227 King St
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Dear Ms. Abel:

Re: Proposed Unitization and EOR of Sinclair Unit No. 4

Please accept from Fairborne Energy Ltd., the following applications:

- Unitization of Sinclair Unit No. 4
- Enhanced Oil Recovery Waterflood Project in Sinclair Unit No. 4

Should you have any additional questions or concerns, please contact Chris Edwards, Operations Engineer at (403)-290-7641 or Krissy Rennie, Landman, at (403) 290-7712.

**FAIRBORNE ENERGY LTD.**

**Chris Edwards P.Eng**
**Operation Engineer**

# Proposed Unitization of Sinclair Unit No. 4

## Application for Enhanced Oil Recovery Waterflood Project
## Sinclair Unit No. 4

Three Forks Unit 4/Bakken Silt

Sinclair Field, Manitoba

October 14, 2009
Fairborne Energy Ltd.

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October 14, 2009

**Subject**

Proposed Unitization of Sinclair Unit No. 4

Application for Enhanced Oil Recovery Waterflood Project

**Introduction**

Fairborne Energy Ltd. (FEL) has developed and is currently operating a Three Forks/Bakken producing oilfield found in the area of Sinclair in Townships 6-7 and Range 29W1 (see Appendix 1). After initial vertical drilling proved existence of substantial hydrocarbon in the Three Forks in this area, FEL has developed the field using stimulated horizontal wells for its primary production phase.

The Three Forks/Bakken is a highly undersaturated light oil reservoir. Exceptionally low gas-oil ratio and bubble point pressure result in rapid pressure depletion and low primary recovery with solution gas drive. As a result, the Sinclair field is an ideal candidate for a waterflood enhanced oil recovery scheme.

Fairborne used the Sinclair Unit No. 1 as its analogue in shaping a waterflood strategy. Using public data, the offsetting unit has been deemed to have a successful waterflood scheme in the identical producing formation as the proposed Sinclair Unit No. 4. Due to the lack of solution gas in the system, it seems reservoir fill-up time was extremely short, with waterflood response being seen in as little as 3 months from initial water injection. The waterflood implementation in FEL's proposed Unit No. 4 will also improve ultimate oil recovery. Expected recoveries have been analyzed using simulation by FEL, and have confirmed that we can expect similar results.

Results of Sinclair Unit No. 1 waterflood can be viewed by referring to the public data filing "Application for Enhanced Oil Recovery Waterflood Project Sinclair Unit No. 3" filed with Manitoba Science Technology Energy and Mines May 25 2009, on page 4 under the heading "Sinclair Pilot Waterflood EOR Response"

**Summary**

1. Proposed Sinclair Unit No. 4 includes 11 horizontal producers and 4 vertical producers (Appendix 1)
2. Original Oil in Place (OOIP) in the proposed unit is 8,551 mstb or 267 mstb/LSD
3. Cumulative production to the end of September, 2009 is approximately 192 mstb
4. Estimated recovery factor under primary is 8%, or 684 mstb (of which 492 mstb is remaining)
5. Peak production from the proposed unit area was 514 bopd in October, 2008 (Appendix 3) or 37 bopd/well from 14 wells

6. September, 2009 production was 183 bopd, with 655 bwpd for a fairly static water cut of 78%. With 15 producing wells, this is an average production of 12.2 bopd/well.
7. Current average annual decline from the proposed unit wells is 25%
8. Recent pressure survey from 6-11-7-29W1 confirms depletion is occurring in the proposed area
9. Based on the analogue Sinclair Unit No. 1, the Bakken/ Three Forks is considered to be a prime candidate for a waterflood application
10. Through simulation (Appendix 5) and analogy, secondary recovery in the proposed unit area is estimated to increase from 8% (primary) to 20%, or 684 mstb to 1,702 mstb, of which 1,510 mstb is remaining as reserves
11. Multi-stage stimulated horizontal producers will be converted to injectors in two phases

## Geological and Engineering Report

### *Geology-*

In the Sinclair area the silty dolomites of the Devonian Three Forks formation unconformably underlies the dolomitic silts and sandstones of the Mississippian Upper Bakken Formation. Locally sediments of the Upper Bakken have filled erosional lows on the pre-Mississippian unconformity.

The Three Forks Unit 4 has been divided into an upper and lower flow unit. The Upper Three Forks Unit 4 consists of a cleaner dolomitic package when compared to the shalier and more finely laminated interval of the Lower Three Forks Unit 4.

The Lower Three Forks Unit 4 conformably overlies the Hematite rich and shaly 'red' beds of the Three Forks Unit 3.

Wireline log and core data have been used to construct structure, and isopach maps. Core data was used to generate porosity thickness (phi-h) and permeability thickness (kh) maps. In the absence of core data on proposed unitized land, petrophysical analysis was used to derive permeability thickness. The cut-off for vshale was 40% and porosity was 6%.

All geological mapping can be found in Appendix 1.

### *OOIP Estimates-*

The Three Forks/Bakken Silt volumetric OOIP within our proposed Sinclair Unit No. 4 area is estimated at 8,551 mstb, which equates to 267 mstb/LSD, and 4,275 mstb/section.

Appendix 2 provides the detailed estimates on a LSD and Section basis, as well as the reservoir parameters used.

***Historical Production-***

Sinclair Unit No.4 historical production plot can be viewed in Appendix 3. Oil production began in February 2005, with a peak production rate of 514 bopd in October, 2008 from 14 wells (4 verticals, 10 horizontals, 37 bopd/well).

Water cuts have minor fluctuations in this area after initial production, sitting at an average water cut of 73% .

***Reserves Estimates-***

As of September 30, the proposed Sinclair Unit No. 4 had produced roughly 192 mstb of oil from the Three Forks/Bakken, which equates to 2.2% of OOIP. Currently the proposed Sinclair Unit No. 4 is on track for a primary recovery of 8% of OOIP, or 684 mstb (342 mstb/sec, 21.4 mstb/LSD) , as approximated by an FEL in-house simulation. It is expected that through a line-drive style waterflood (injector-producer-injector-producer) recoveries can be increased to 20% of OOIP, or 1,710 mstb (855 mstb, 53.4 mstb/LSD). Please see Appendix 5 to view complete simulation results.

**Unitization** (please refer to submitted Sinclair Unit No. 4 Unit Agreement for further details)

***Unit Name-***

FEL proposes the official name of Sinclair Unit No. 4

***Unit Operator-***

Fairborne Energy Ltd. will be operator of record for Sinclair Unit No. 4

***Unit Wells-***

The list of 15 unit wells is included in Appendix 4

***Unit Lands-***

The Sinclair Unit consists of the sections:

- Sec 11 Twp 7 Rge 29W1
- Sec 14 Twp 7 Rge 29W1

32 LSD's are included in the unit and are assigned 40 tracts based on each LSD spacing (see Appendix 2)

### *Tract Factors-*

The proposed unit consists of 40 tract factors based on LSD spacings. All tract factors were based on OOIP for that LSD from internal FEL mapping. Complete tract factor listing can be found in Appendix 2.

Historical production from current producers was not included in the calculation to determine tracts. The following reasons played into this:

- In multi-fractured horizontals, you are never really sure from what interval or lsd the oil is being produced out of, as measurement is only economically possible from surface
- Some of our higher producers may have been a result of being produced early in the life of the pool, before depletion had taken place, hence higher production
- Some of our poorer producers may have been a result of being produced late in the life of the pool, when depletion had already taken place, hence lower production
- Due to the process that takes place during the stimulation of a well, several problems have occurred, including sandoffs and other technical issues, which impact performance of the well

As a result of this reasoning, we feel that there are too many uncertainties in which to base tract factors on production data for this unit. Using OOIP we feel would then be the best alternative.

### *Working Interest Owners-*

Working interest details are included in Appendix 2 for each LSD/tract. FEL is 100% WI in all of these lands, and thus 100% in Sinclair Unit No. 4

## Waterflood Development/Operations

### *Injector Pattern and Conversions*

After reviewing positive results from the Sinclair Unit No. 1 waterflood, and running internal models (Appendix 5), it has been determined that the most effective development scenario for a horizontal waterflood would be producer-injector-producer setup on 200m spacing between offsetting horizontal legs, mimicking a line-drive pattern from a vertically developed field.

Due to existing producers in the proposed Sinclair Unit No. 4 not being in an ideal N/S or E/W pattern, Fairborne will begin with conversion of two existing producers per section, that have offsetting producers. If successful, FEL will review new drill development in the future.

Four wells are to be converted from producer to injectors in total (listed in Appendix 4). The current timeline in place is for the first two conversions to occur in early December,

2009, with injection beginning immediately. The second two will be converted in February, 2010.

### *Injection Fluid*

The injection fluid used in the proposed waterflood will come from existing FEL Three Forks producers. No compatibility tests have been conducted as a result of non-foreign fluid being introduced. As well, FEL's processing system is largely fiberglass, so it is not anticipated that the chemistry of the water will be significantly altered at any point between production and injection.

FEL currently produces enough Three Forks water to achieve the volumes we hope to inject long term in the Sinclair Unit No. 4. In the event that we require an alternate water source, FEL will prepare an amendment to this application.

### *Injection Facilities*

For the Sinclair Unit No. 4 waterflood, FEL has planned to construct only temporary wellsite facilities until positive waterflood response is seen and the quality measured. Wellsite facilities will include tankage, pump skid, filtration, measurement, and instrumentation to control injection pressure and rate. See detailed drawings in Appendix 6. After confirmation of waterflood success, permanent facilities will designed and constructed pending amendment to this application. It is estimated this will occur after 6 months from initial injection.

FEL plans to use fiberglass and coated steel in all aspects of the temporary facility, in order to reduce the need for any corrosion chemicals to be used.

### *Recompletions*

For the 4 producer-injector conversions, tubing and rods will be removed from each well and replaced with coated tubing. Wellhead will also be replaced with a coated wellhead. Injectivity test will be conducted. For full details, please see sample workover program and downhole diagram in Appendix 7.

### *Reservoir Pressure*

The most recent pressure data documented in proposed Sinclair Unit No. 4, occurred on Aug 29, 2009, on the well 00/6-11-7-29W1. The vertical well had been down for had been down for 85 days, so it was assumed that the resulting reservoir pressure would give us a representative static bottomhole pressure for section 11. The resulting pressure of 4,015 kPa was in the range we had expected. In Appendix 8 you will find the official pressure survey report.

### *Injection Rate and Pressure*

The target injection rate that has been chosen is 60 m3/well (injectivity limited). This will provide us with an initial voidage replacement of 150% of the maximum withdrawal rate in this area. However, 85% of the **surface fracture pressure of ~4,800 kPa** will not be exceeded to meet this target. This is not expected to be an issue using stimulated wellbores.

### *Surveillance and Optimization*

Monitoring of the proposed Sinclair Unit No. 4 waterflood will include:

- Daily wellhead sampling of producers directly offsetting injectors in order to monitor BS&W percent changes over time (any premature water breakthrough or viscous fingering will be caught through this method)
- Weekly testing of produced volumes from offset producers, in order to gauge waterflood response
- Fluid level monitoring in offsetting producers
- Daily injected volume recording
- Analysis/tracking of any changes in injection pressure and injected rate during the life of the flood
- Analysis/tracking of the stage of voidage replacement, in order to proactively plan injected rate optimization strategies
- Providing monthly injection targets to field personnel, based on producer responses and stage of reservoir fill up
- Continual monitoring of pattern performance, which will provide the info needed to further optimize each pattern

## Notifications

FEL has mailed notification of this unitization and EOR scheme to all surface owners and mineral owners within the unit boundary and within 0.5km of the boundary. A listing of surface and mineral owners within the notification boundary is attached in Appendix 9. A copy of the registered mail notification is attached in Appendix 9.

## List of Appendices

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2. OOIP/Tract Factor Calculation
3. Production Plot (historical and forecast)
4. Unit Well List (includes injector candidate info0
5. Simulation Summary
6. Drawing of Proposed Facility
7. Downhole Diagram and Conversion Program
8. Pressure Survey
9. Listing of Mineral and Surface Owners
10. Geological Cross-Section