Alberta Bound?
The Renaissance of the Alberta Viking

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All values in this document are in C$ unless otherwise specified.
Provost is emerging as an extension of Dodsland
## WCSB Key Play Activity

### Play Summary – Wells Spud and Total Production

<table>
<thead>
<tr>
<th>Play</th>
<th>May-17 (well count)</th>
<th>vs. May-16 (%)</th>
<th>Direction</th>
<th>Mar-17 (boe/d)</th>
<th>vs. Feb-17 (%)</th>
<th>vs. Jan-17 (%)</th>
<th>vs. Mar-16 (%)</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viking</td>
<td>21</td>
<td>11</td>
<td>91%</td>
<td>159,088</td>
<td>3%</td>
<td>8%</td>
<td>13%</td>
<td>↑</td>
</tr>
<tr>
<td>Montney</td>
<td>19</td>
<td>17</td>
<td>12%</td>
<td>1,055,147</td>
<td>1%</td>
<td>0%</td>
<td>5%</td>
<td>↑</td>
</tr>
<tr>
<td>Duvernay</td>
<td>6</td>
<td>13</td>
<td>(54%)</td>
<td>61,844</td>
<td>3%</td>
<td>3%</td>
<td>24%</td>
<td>↑</td>
</tr>
<tr>
<td>Spirit River</td>
<td>3</td>
<td>9</td>
<td>(67%)</td>
<td>558,826</td>
<td>6%</td>
<td>4%</td>
<td>3%</td>
<td>↑</td>
</tr>
<tr>
<td>Cardium</td>
<td>5</td>
<td>4</td>
<td>25%</td>
<td>196,855</td>
<td>1%</td>
<td>4%</td>
<td>(9%)</td>
<td>↓</td>
</tr>
<tr>
<td>Bakken</td>
<td>3</td>
<td>2</td>
<td>50%</td>
<td>80,848</td>
<td>1%</td>
<td>1%</td>
<td>(13%)</td>
<td>↓</td>
</tr>
<tr>
<td>SE Sask Mississippian</td>
<td>7</td>
<td>2</td>
<td>250%</td>
<td>127,905</td>
<td>2%</td>
<td>3%</td>
<td>(1%)</td>
<td>↓</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td><strong>64</strong></td>
<td><strong>58</strong></td>
<td><strong>44%</strong></td>
<td><strong>2,240,514</strong></td>
<td><strong>2%</strong></td>
<td><strong>3%</strong></td>
<td><strong>3%</strong></td>
<td><strong>↑</strong></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td><strong>59</strong></td>
<td><strong>34</strong></td>
<td><strong>74%</strong></td>
<td><strong>2,214,445</strong></td>
<td><strong>0%</strong></td>
<td><strong>1%</strong></td>
<td><strong>(3%)</strong></td>
<td><strong>↓</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>123</strong></td>
<td><strong>92</strong></td>
<td><strong>33.7%</strong></td>
<td><strong>4,454,959</strong></td>
<td><strong>1.3%</strong></td>
<td><strong>1.3%</strong></td>
<td><strong>(1.2%)</strong></td>
<td><strong>↓</strong></td>
</tr>
</tbody>
</table>

Viking is the most drilled formation in the WCSB in 2017

Source: BMO Capital Markets A&D Market Monitor – Calgary June 2017, Bloomberg, GeoSCOUT, GeoEDGES

Note: This page does not include mining or thermal production or conventional wells from the Northwest Territories. Production as of March 2017. Spud and License data as of May 29, 2017. All wells with no production and a rig release prior to Jan. 2010 are not shown. All wells with no production in LTM or with most recent month production of less than 10 boe/d are not shown.
Unitized Viking gas originally helped fill the TCPL mainline
MORE THAN SIXTY YEARS OF VIKING PRODUCTION IN PROVOST AND DODSLAND

Provost total Viking production was higher than Dodsland until 1994

2010 Sharp increase in Hz wells in Dodsland

~ 5,500 horizontal wells have been drilled since 2008

Horizontal drilling successfully unlocks Viking oil

Source: GeoSCOUT, BMO Capital Markets
Note: All production values are raw oil and gas volumes collected from public sources and do not include any extracted natural gas liquids
* Oil rates include condensate volumes which account for less than 1% of the total liquids. Well counts and Production are as of April 2017
STRATIGRAPHIC TRAPPING (1)

Source: GeoSCOUT, GeoEdges, BMO Capital Markets
1. Modified after 2005, SGS Hoosier SK Viking
Regional Viking at Dodsland

Kerrobert

Kindersley

Dodsland

Whiteside

Plato

101/06-05-030-25W3 - WHITESIDE

Average Core Porosity 21%

111/08-04-031-18W3 - DODSLAND

Average Core Porosity 22%

Source: GeoSCOUT, GeoEdges, Corporate Presentations, BMO Capital Markets

OOIP calculations are based on Sw = 35%, net pay = 75% of gross sand thickness
Geological Setting | Provost – The Same but Different

RATIONALE: Geological Setting at Provost

- **Regional Viking at Provost**

  - **Halkirk**
  - **Provost**
  - **Hamilton Lake**
  - **Esther**

100/04-28-034-08W4 - HAMILTON LAKE
- Average Log Porosity: 20%

100/06-24-035-05W4 - PROVOST
- Average Log Porosity: 18%

**Source:** GeoSCOUT, GeoEdges, Corporate Presentations, BMO Capital Markets

*OOIP calculations are based on Sw = 35%, net pay = 75% of gross sand thickness*
Dodsland vs Provost | Porosity and Permeability

**DODSLAND POROSITY VS PERMEABILITY**

- **Porosity - Kmax (md)**
  - Kindersley
  - Kerrobert
  - Dodsland

- **Permeability - KVert (md)**
  - Kindersley Median
  - Kerrobert Median
  - Dodsland Median

- **Proportion:** 23%
  - 5.6-6.9 mD

**DODSLAND HORIZONTAL VS VERTICAL PERMEABILITY**

- **Horizontal Permeability - K90 (md)**
  - Kindersley Median
  - Kerrobert Median
  - Dodsland Median

- **Vertical Permeability - KVert (md)**
  - Kindersley Median
  - Kerrobert Median
  - Dodsland Median

- **Values:**
  - 13 mD (KHz)
  - 1.6 mD (KVert)

**PROVOST POROSITY VS PERMEABILITY**

- **Porosity - Kmax (md)**
  - Provost West
  - Provost E Median
  - Esther

- **Permeability - KVert (md)**
  - Provost W Median
  - Provost E Median
  - Esther Median

- **Proportion:** 21%
  - 6.5-12 mD

**PROVOST HORIZONTAL VS VERTICAL PERMEABILITY**

- **Horizontal Permeability - K90 (md)**
  - Provost W Median
  - Provost E Median
  - Esther Median

- **Vertical Permeability - KVert (md)**
  - Provost W Median
  - Provost E Median
  - Esther Median

- **Values:**
  - 20 mD (KHz)
  - 1.7 mD (KVert)

**Similar overall average values but Provost has wider range**

Source: GeoSCOUT, BMO Capital Markets
Land positions are tightly held through legacy production

Source: GeoSCOUT, GeoEdges, BMO Capital Markets
Increasing Production and Liquids Percent in All Areas

**PROVOST PRODUCTION BY OPERATOR***

- **Other, Penn West, Rolling Hills**
- **Tamarack, Spartan, NAL, Novus, ISH, CPG, WCP, RRX, Tamarack**
- **Teine, Raging River, Whitecap**
- **Liquids**

- **Cal Day Rate (Mboe/d)**
- **Liq. Percentage**

2012 2013 2014 2015 2016 2017

- > 20 Mboe/d
- 9,000 bbl/d

**DODSLAND PRODUCTION BY OPERATOR***

- **Other, Tamarack, Spartan, NAL, Novus, ISH, CPG, WCP, RRX, Teine**
- **Liquids**

2012 2013 2014 2015 2016 2017

- > 62 Mboe/d
- 49,000 bbl/d

**PROVOST DRILLING ACTIVITY***

- **Other, Toro, Karve, Husky, San Ling, High Ground, PWT, RRX, Tamarack, APA, CPG**

- **# of Wells Spud**

2012 2013 2014 2015 2016 2017

- Activity sustained through the downturn

**DODSLAND DRILLING ACTIVITY***

- **Other, Tamarack, Spartan, NAL, Novus, ISH, CPG, WCP, RRX, Teine**

2012 2013 2014 2015 2016 2017

- 2015-2016 Drilling was down 13%

*Source: GeoSCOUT, BMO Capital Markets

Note: All production values are raw oil and gas volumes collected from public sources and do not include any extracted natural gas liquids

*Oil rates include condensate volumes which account for less than 1% of the total liquids. Well counts and Production are as of April 2017

Provost production starts to increase in late 2016
255 MMbbl (liquids) and 2.98 Tcf (gas) recovered
~9,300 wells producing and most were vertical
VIKING SITUATION MAP – END OF FEBRUARY 2017

~16 MMbbl of incremental oil captured at Provost and 83 MMbbl at Dodsland

Source: GeoSCOUT, GeoEdges, BMO Capital Markets
Note: All production values are raw oil and gas volumes collected from public sources and do not include any extracted natural gas liquids. Cumulative volumes are as of February 2017
Techniques Used to Exploit this Oil-Rich Viking Source

- Horizontal development in previously thought to be only gas producing areas
- Downspacing - 200 m interwell spacing
- Horizontal development in previously water flooded areas
- Longer lateral length increases economics of play

Dodsland strategies are key to unlocking Provost oil
Does Previous Gas Production Matter?

PROVOST GAS AND OIL (TWP 035-05W4)

Cumulative Gas Mboe
32 755

Cumulative Oil/Cond Mboe
0.1 434

DODSLAND GAS AND OIL (TWP 030-24W3)

Source: GeoSCOUT, GeoEdges, BMO Capital Markets
Note: Sections are assumed to be 640 acres
Oil wells have average IPs >50 bbl/d and GORs of ~3,000 scf/bbl
400 m spacing suggests a RF of 1% to 5% ➔ 200 m downspacing
SECTION 36-032-20W3 (NAL RESOURCES)

Cumulative Gas Mboe
6 58
Cumulative Oil/Cond Mboe
49 581

OOIP estimate
11.8 MMbbl (5.4 m @ 24% Φ)
6.5 MMbbl (3 m @ 24% Φ)

SECTION 36-032-20W3 RATE VS TIME

400 m spacing
48 bbl/d
200 m spacing

Avg. IP₃₀

GOR

SECTION 36-032-20W3 RATE VS CUM

400 m spacing
200 m spacing

EUR
~800 Mbbl
RF
12% (3 m of pay)
7% (5.4 m of pay)

16 wells at 200 m spacing
~50 Mbbl per well

Originally drilled to 400 m spacing ➔ 200 m spacing doubles EUR

Source: GeoSCOUT, GeoEdges, BMO Capital Markets
Note: Sections are assumed to be 640 acres. All production values are raw oil and gas volumes collected from public sources and do not include any extracted natural gas liquids. Production values are as of April 2017
200 m Well Spacing Increases Reserves | Provost

SECTION 28-034-08W4 (TAMARACK VALLEY)

Tamarack Valley operated
Drilled by Spur Resources

Cumulative Gas
Mboe

12
327

Cumulative Oil/Cond
Mboe

0.3
158

OOIP estimate
4.9 MMbbl
(3 m @ 18% Φ)
13.1 MMbbl
(8 m @ 18% Φ)

Zoomed area

SECTION 28-034-08W4 RATE VS TIME

No significant oil production before 2015-02

Avg. IP30
71 bbl/d

SECTION 28-034-08W4 RATE VS CUM

5 wells at 200 m spacing
~60 Mbbl per well

EUR
~300 Mbbl
RF
2.3 % (8 m of pay)
6.1% (3 m of pay)

Five wells at 200 m spacing with each has an avg. IP30 of 71 bbl/d

Source: GeoSCOUT, GeoEdges, BMO Capital Markets
Note: Sections are assumed to be 640 acres. All production values are raw oil and gas volumes collected from public sources and do not include any extracted natural gas liquids.
Production values are as of April 2017
Hz wells in previously flooded zones have surprisingly low WCs.
Section 27-035-10W4 (TORO Oil & Gas)

**SECTION 27-035-10W4 RATE VS TIME**

- **Cumulative Gas Mboe**: 12-156
- **Cumulative Oil/Cond Mboe**: 0.2-1,474

**SECTION 27-035-10W4 RATE VS CUM**

- **OOIP estimate**: 4.6 MMbbl (1.8 m @ 28% Φ)
- **CTD**: 656 Mbbl
- **Inj Water**: Injection stopped in 1986
- **EUR**: ~800 Mbbl
- **RF**: 17%

**Indication of continuing pressure support**

Source: GeoSCOUT, GeoEdges, BMO Capital Markets

Note: Sections are assumed to be 640 acres. All production values are raw oil and gas volumes collected from public sources and do not include any extracted natural gas liquids. Production values are as of April 2017.
Waterflood Areas | Continued Pressure Support?

**DODSLAND 191/01-26-031-23W3 RATE VS TIME**

- **Stable Water cut**
- **Decreased GOR**
- **Decline 10-20%/yr**

**DODSLAND 102/04-26-031-23W3 RATE VS TIME**

- **Decline 0%**

**PROVOST 102/16-27-035-10W4 RATE VS TIME**

- **Stable Water cut**
- **Decreased GOR**

**PROVOST 100/06-21-035-10W4 RATE VS TIME**

- **Stable Water cut**

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Source: GeoSCOUT, GeoEdges, BMO Capital Markets

Note: All production values are raw oil and gas volumes collected from public sources and do not include any extracted natural gas liquids. Production values are as of March 2017
Longer wells are becoming more common

Source: GeoSCOUT, GeoEdges, BMO Capital Markets
Note: All production values are raw oil volumes collected from public sources. 

n = number of wells
LATERAL LENGTH DRILLING ACTIVITY

1 mile wells show the best IP and are becoming the length of choice.
Increased length and proppant placed paired with significant decrease in costs

Note: Data subset are wells spud post Jan 1, 2014
Higher concentration of ERH wells is reflected in the well costs.

Note: Data subset are wells spud post Jan 1, 2014
Execution is a key factor
Conservative TC economics show good IRRs at current pricing

**HORIZONTAL OIL TYPE CURVES BASED ON 2014 ONWARD WELLS**

- 1 mile: IP₃₀ 86 bbl/d
- 3/4 mile: IP₃₀ 60 bbl/d
- 1/2 mile: IP₃₀ 47 bbl/d

**3/4 MILE TYPE CURVE SENSITIVITIES**

- Rate of Return Sensitivity on Base Type Curve:
  - WTI Oil Price (US$/bbl): $35/bbl to $65/bbl
  - Capital ($M): $650 to $800 to $970
  - IP (30-day, bbl/d): 47 to 72
  - GOR (scf/bbl): 6,200 to 9,200
  - Gas Price ($/GJ): $2.00 to $3.00

**TYPE CURVE ECONOMIC RESULTS SUMMARY**

<table>
<thead>
<tr>
<th></th>
<th>0.5 mile</th>
<th>0.75 mile</th>
<th>1 mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP₃₀ (bbl/d)</td>
<td>47</td>
<td>60</td>
<td>86</td>
</tr>
<tr>
<td>EUR (Mboe)</td>
<td>51</td>
<td>65</td>
<td>101</td>
</tr>
<tr>
<td>GOR (scf/bbl)</td>
<td>6,200</td>
<td>6,200</td>
<td>6,200</td>
</tr>
<tr>
<td>CND Liquids Yield (bbl/MMcf)</td>
<td>13</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>C₃ - C₄ Liquids Yield (bbl/MMcf)</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Capital ($M)</td>
<td>$650</td>
<td>$800</td>
<td>$970</td>
</tr>
<tr>
<td>Fixed Costs ($/well/month)</td>
<td>$2,500</td>
<td>$2,500</td>
<td>$2,500</td>
</tr>
<tr>
<td>Variable Oil Costs ($/bbl)</td>
<td>$12.00</td>
<td>$12.00</td>
<td>$12.00</td>
</tr>
<tr>
<td>Variable Gas Costs ($/Mcf)</td>
<td>$1.00</td>
<td>$1.00</td>
<td>$1.00</td>
</tr>
<tr>
<td>Yr 1 Op cost ($/boe)</td>
<td>$10.10</td>
<td>$9.79</td>
<td>$9.46</td>
</tr>
</tbody>
</table>

Source: GeoSCOUT, BMO Capital Markets, Economics evaluated using Value Navigator 2016
Note: Based on flat price deck with US$50/bbl WTI and C$2.5/GJ AECO, USD/CAD = 1.33; -C$5/bbl diff to Edm Light
The C* calculation assumes the following inputs: total proppant = 572 tons 1 mile, 375 tons 3/4 mile and 250 tons 1/2 mile; TVD = 800 m
Why are Viking operators “Alberta Bound”?

- Horizontal development in previously thought to be only gas producing areas
  - Large oil-in-place, light oil, underdeveloped

- Downspacing - 200 m interwell spacing
  - Low cost, short cycle-time, quick payback

- Horizontal development in previously water flooded areas
  - Proven development techniques

- Longer lateral length increases economics of play
  - Ample processing facilities and infrastructure
  - Easy access to gas and oil market pipelines

Expect to see increased A&D activity and increased oil production in Provost
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