Overview

- Horizontal Montney development began in 2007. By the end of 2010, horizontal production from across the fairway had reached 1.33 Bcf/d (~1.39 Bce/d); most of this production was drier gas from the prolific areas (~10 bbl/MMcf of C₆+).

- By 2014, commodity pricing had encouraged operators to follow the liquids and develop areas with significant condensate providing the best possible return on investment.

- The Alberta liquids-rich gas fairway includes the areas of Pipestone, Elmworth, Bilbo, and Kakwa. Here, condensate-rich gas has been proven and continues to be developed in the Upper and Middle Montney with tremendous untapped potential remaining in the Lower Montney.

- Several companies have identified an expanding and lucrative tight-oil fairway from Pipestone (eastern side), to Gold Creek and Karr with development focusing on the Middle Montney Turbidite. Recent land sales show a clear trend pushing the edges to the north and east.

- Operators in the core areas continue to develop and improve well performance by refining drilling and completion techniques; these learnings are being implemented across the fairway with success.

- Well activity continues to reinforce the study area’s potential to be a major hydrocarbon liquids centre, receiving significant capital allocation.

- Our review will compare economics from several of the major players across both the condensate-rich core and the emerging tight-oil areas, and show why capital continues to be spent in the fairway “Unlocking the Treasure.”

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Horizontal wells RR’ed⁽¹⁾ - proportion by area

- Growing proportion of drilling activity

Horizontal production by area⁽²⁾ (Cal Day MMcfe/d)

- Rapid production growth: Currently ~22% of total

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⁽¹⁾ Source: geoSCOUT, GeoEdges, BMO Capital Markets
⁽²⁾ Rig Release data as of March 31, 2018
⁽³⁾ Public production data (Jan, 2017) is raw gas, oil and field condensate which is rarely reported. Production does not include plant liquids.
- The Montney depositional environment ranges from distal offshore to upper shoreface. Middle Montney Turbidite channels and fan complexes are present in the study area and these deposits are generally more porous than the regional ramp silstones.
- Drill depth to the Montney varies greatly. In the south the Montney is 3,600 m deep and operators require intermediate casing, which will significantly impact drilling costs.
- The Montney gross isopach is surprisingly consistent across the study area (North/South and East/West) at ≈ 200 m, and all benches (Upper, Middle and Lower Montney) have been proven productive.
Continues to attract significant capital with almost 3X production growth in the last two years
350 wells currently licensed or drilling and more than 300 wells rig released since January 2017

Source: geoSCOUT, BMO Capital Markets
NOTE: spud and license data as of March 31, 2018
(1) Public production data (Jan 2018) is raw gas, oil and field condensate which is rarely reported. Production does not include plant liquids; Horizontal wells only
(2) Producing: produced in the last 12 months (LTM); Standing: no production but rig released in the LTM; Location & Drilling: new in the last 2 years with no RR date on record; Horizontal wells only
Holdings Dominated by Pure Alberta Montney Players

Recent Crown Sales are Focused in the Northeast

Lands in the fairway core have been tightly held since 2012 with recent sales pushing into the liquids-prone areas

Source: Public presentations and press releases, geOSCOUT, BMO Capital Markets
Note: overlapping land positions may not fully illustrate individual company land holdings
Methodology

- The hydrocarbon fairway map was prepared using available recombined public production data, gas analyses (either pre separator or recombined), and corporate disclosure.
- Significant uncertainties and gaps exist in condensate reporting as a result of extraction point and well confidentiality, therefore this map represents a regional best estimate of the condensate fairway. Most of the drilling has been focused on the Upper and Middle Montney and as such the fairway map best represents these two benches.
- On the map, deep dry gas areas are shown in red and the liquids-rich gas fairway is shown as an orange to yellow gradation. The transition from the ultra-rich gas to the emerging tight-light volatile oil fairway is graded from yellow to green.
- Width of the fairway is variable and possibly reflects variations in thermal gradients, thickness variances of stratigraphic sequences, and/or complex migration of hydrocarbons.
- Five geographic areas have been examined in detail on the following pages; the established developments at Pipestone, Elmworth/Bilbo and Kakwa are prone to be liquids-rich gas with varying liquid yields. The emerging areas of east Pipestone - Gold Creek and Karr - are predominantly volatile oil and light oil.
- The type curves were developed based on public operator disclosure and, in almost all cases, represent future or next generation well designs providing higher well performance, rather than showing historical production averages.
- Type curves have been run on flat prices of $60 WTI and $2/GJ assuming an Fx of $1.25 US/CAN.
- Drilling and completion well designs are continually evolving and can vary significantly between operators and areas resulting in variable well costs, drilling and completion costs; design variations can include orientation and well placement (‘W’ or cube), proppant intensity, number of frac stages, and lateral lengths.
- Operators are evolving strategies to try to manage long-term well performance (in particular condensate production and water flow back) with methods such as soaking or restricting early production (slow-back).
- All areas show favourable economics which is why the Alberta Montney is garnering its fair share of capital commitment leading to delineation in the understanding of the extent and types of hydrocarbons in this region.
Maturity of the Alberta Montney Sub-Plays

- Kakwa: Seven Generations is in full development mode at Nest 2 with >140 wells licensed
- Elmworth: NuVista and Paramount are developing their core lands
- Pipestone: Encana is ramping up drilling with 25 wells licensed

The more mature plays of Kakwa and Elmworth are now appraising non-core areas and the Lower Montney interval while Pipestone, Gold Creek, and Karr continue to delineate

Source: geoSCOUT, BMO Capital Markets, Verdazo Analytics, economics evaluated using Value Navigator 2017, Corporate Presentations
Note: Based on flat prices with US$60/bbl WTI and C$2.00/GJ AECO, USD/CAD = 1.25; ~C$3.81/bbl diff to Edm Light
Elmworth to Bilbo - Condensate-Rich Gas

Elmworth and Bilbo in the Core of the Condensate-rich Fairway

*Elmworth to Bilbo may yet yield richer gas than previously thought*

102/03-35-065-06W6/00
Vertical Type Log

*93 permits or drilling 26 confidential wells*

Montney wells included in Type Curve Analysis
- All Montney Wells
- Upper and Middle Montney Wells
- Lower Montney Wells
- Drilling or Licensed

Type Log - >200 m of Gross Thickness, Porosity Throughout

102/03-35-065-06W6/00
NUVISTA 102 BILBO 3-35-65-6

Upper Montney

Middle Montney

Lower Montney

Primary Targets are the Upper and Middle Montney

3% Limestone Porosity
40 ohm Resistivity

Lower Montney delineations suggest significant liquids potential

**Full development underway with Upper and Middle Montney as proven producers of high liquid volumes**

**Recent targeting of Lower Montney is very promising**
NuVista and Paramount are Major Players in Elmworth/Bilbo

- **POU Upper & Middle Montney**
  - 4 well Avg 1,330 boe/d (44% CND)
  - Lower 3 well Avg 2,073 boe/d (47% CND)

- **Shell 15-12-67-5 Middle Montney**
  - CGR ~ 227 bbl/MMcf

- **NuVista (Elmworth)**
  - 30 wells on Production Avg IPp 7.4 MMcf/d (Raw) and 418 bbl/d (C+) 57 bbl/MMcf

- **NuVista (Gold Creek)**
  - 5 well average IPp 5.0 MMcf/d (Raw) and 408 bbl/d (C+) 81 bbl/MMcf

- **NuVista (Bilbo)**
  - 56 Producing wells Avg IPp 6.0 MMcf/d (Raw) and 749 bbl/d (C+) 124 bbl/MMcf testing Lower Montney IPp 3.6 MMcf/d (Raw) and 665 bbl/d (C+) 182 bbl/MMcf

- **POU 26 wells Average IPp 1,970 boe/d (59% CND)**

Condensate-Rich Type Curve (Cal Day Gas Rate MMcf/d)

- **POU SW (Karr)**
- **NuVista East (Gold Creek)**
- **Paramount SE (Karr)**
- **Paramount N (Wapiti)**
- **NuVista West (Elmworth)**
- **NuVista South (Bilbo)**

**Type Curve Parameters**

<table>
<thead>
<tr>
<th></th>
<th>NuVista West (Elmworth)</th>
<th>NuVista South (Bilbo)</th>
<th>Paramount SW (Karr)</th>
<th>NuVista East (Gold Creek)</th>
<th>Paramount SE (Karr)</th>
<th>Paramount N (Wapiti)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BT-NPV@10% ($MM)</td>
<td>$4.4</td>
<td>$7.4</td>
<td>$12.0</td>
<td>$5.2</td>
<td>$9.1</td>
<td>$9.5</td>
</tr>
<tr>
<td>IRR (%)</td>
<td>44%</td>
<td>109%</td>
<td>90%</td>
<td>58%</td>
<td>66%</td>
<td>73%</td>
</tr>
<tr>
<td>Payout (yrs)</td>
<td>1.7</td>
<td>0.9</td>
<td>1.0</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
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<tr>
<td>P/I@10%</td>
<td>0.5</td>
<td>0.9</td>
<td>0.9</td>
<td>0.5</td>
<td>0.7</td>
<td>0.8</td>
</tr>
<tr>
<td>Raw Gas Pp (Mcf/d)</td>
<td>7,000</td>
<td>7,000</td>
<td>4,617</td>
<td>7,000</td>
<td>5,000</td>
<td>5,940</td>
</tr>
<tr>
<td>Liquids EUR (Mbbl)</td>
<td>421</td>
<td>461</td>
<td>639</td>
<td>500</td>
<td>550</td>
<td>568</td>
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<tr>
<td>Sales Gas EUR (Bcf)</td>
<td>6.0</td>
<td>4.7</td>
<td>4.8</td>
<td>5.0</td>
<td>5.2</td>
<td>5.0</td>
</tr>
<tr>
<td>Ut Rec (Mboe)</td>
<td>1,419</td>
<td>1,244</td>
<td>1,333</td>
<td>1,334</td>
<td>1,419</td>
<td>1,408</td>
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<tr>
<td>% Liquids</td>
<td>30%</td>
<td>37%</td>
<td>45%</td>
<td>37%</td>
<td>39%</td>
<td>40%</td>
</tr>
<tr>
<td>C1+ (bbl/MMcf)</td>
<td>57 to 40</td>
<td>124 to 75</td>
<td>235 to 80</td>
<td>105 to 60</td>
<td>145 to 67</td>
<td>177 to 74</td>
</tr>
<tr>
<td>C2-C4 (bbl/MMcf)</td>
<td>19</td>
<td>11</td>
<td>13</td>
<td>19</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Capital ($MM)</td>
<td>$8.4</td>
<td>$8.6</td>
<td>$12.8</td>
<td>$10.8</td>
<td>$12.8</td>
<td>$12.5</td>
</tr>
<tr>
<td>C* ($MM)</td>
<td>$13.6</td>
<td>$15.8</td>
<td>$21.2</td>
<td>$16.5</td>
<td>$21.2</td>
<td>$22.2</td>
</tr>
</tbody>
</table>

Large area spanning across many phase windows leads to variable results

Application of advanced completion techniques has delivered improved IRRs


Note: Based on flat price deck with US$60/bbl WTI and C$2.00/GJ AECO, USD/CAD = 1.25; <$3.81/bbl diff to Edm Light
Established area. Next steps are a near field expansion, including an already identified area to the south.
Advanced completion techniques are resulting in stellar well performance
Seven Generations currently appraising lands to the south, referred to as Nest 3
Pipestone - Delineating a New Liquids Giant

Pipestone Area is Rich Gas Moving into Volatile Oil

Type Log - 192 m Section; Evident Porosity in Middle Montney

102/01-03-072-09W6/00
CNRL ALBRT 1-3-72-9

Current Wells
Target Upper and Middle Montney

3% Limestone Porosity
40 ohm Resistivity

Additional Upside Potential

Multiple targeted zones producing from oil to lean gas in the Upper and Middle Montney
Additional upside inventory in Lower Montney
Encana, NuVista, and Blackbird have significant positions at Pipestone.

**Pipestone Ultra-Rich Type Curve (Cal Day Gas Rate MMcf/d)**

**Type Curve Parameters**

<table>
<thead>
<tr>
<th></th>
<th>NuVista Rich CND</th>
<th>Blackbird Rich Condensate/Volatile Oil</th>
<th>ECA Volatile Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>BT-NPV@10% ($MM)</td>
<td>$4.6 $5.5 $6.0</td>
<td>$7.7 $9.5 $13.2</td>
<td>$10.6 $14.5</td>
</tr>
<tr>
<td>IRR (%)</td>
<td>61%</td>
<td>88%</td>
<td>358%</td>
</tr>
<tr>
<td>Payout (yrs)</td>
<td>1.3 $1.2 0.5</td>
<td>1.2</td>
<td>0.5</td>
</tr>
<tr>
<td>PI (@10%)</td>
<td>0.7</td>
<td>1.4</td>
<td>1.8</td>
</tr>
<tr>
<td>Raw Gas Pd (Mcf/d)</td>
<td>6,642 2,700 2,700</td>
<td>2,700 $2,700 2,700</td>
<td>2,700 $2,700 2,700</td>
</tr>
<tr>
<td>Liquids EUR (Mbbl)</td>
<td>350 356 474</td>
<td>356</td>
<td>474</td>
</tr>
<tr>
<td>Sales Gas EUR (Bcf)</td>
<td>4.7 3.2 2.4</td>
<td>3.2</td>
<td>2.4</td>
</tr>
<tr>
<td>Ult Rec (Mboe)</td>
<td>1,130</td>
<td>886</td>
<td>869</td>
</tr>
<tr>
<td>% Liquids</td>
<td>31%</td>
<td>40%</td>
<td>55%</td>
</tr>
<tr>
<td>C5+ (bbl/MMcf)</td>
<td>60</td>
<td>100</td>
<td>270 to 150</td>
</tr>
<tr>
<td>C2-C4 (bbl/MMcf)</td>
<td>10</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Capital ($MM)</td>
<td>$7.0 $5.5 $6.0</td>
<td>$5.5</td>
<td>$6.0</td>
</tr>
<tr>
<td>C* ($MM)</td>
<td>$9.5 $13.2 $14.5</td>
<td>$13.2</td>
<td>$14.5</td>
</tr>
</tbody>
</table>

**Encana’s Pipestone Montney is emerging as a top play with unbeatable returns in the volatile oil window**


Note: Based on flat prices with US$60/bbl WTI and C$2.00/GJ AECO, USD/CAD = 1.25; C$3.81/bbl diff to Edm Light.
Proven oil-producing interval in Gold Creek. The extent of the play is being delineated in the North Water handling may be of increasing importance as development continues
Golden Opportunities in the Gold Creek

Hammerhead, Iron Bridge, and Velvet Have Significant Exposure Here

---

Gold Creek Oil Type Curves (Cal Day Oil Rate bbl/d)

- **Hammerhead Base**
  - BT-NPV@10% (MM): $5.1
  - IRR (%): 109%
  - Payout (yrs): 1.0
  - P/I (@10%): 1.1
  - IP: 379 (bbl/d)
  - Liquids EUR (Mbbl): 390
  - Sales Gas EUR (Bcf): 2.1
  - UI Rec (Mboe): 227
  - % Liquids: 46%
  - C5+ (bbl/MMcf): 8
  - C2-C4 (bbl/MMcf): 8
  - Capital ($MM): $4.6
  - C* ($MM): $9.4

- **Hammerhead Sweet Spot**
  - BT-NPV@10% (MM): $14.7
  - IRR (%): >500%
  - Payout (yrs): 0.5
  - P/I (@10%): 3.2
  - IP: 615 (bbl/d)
  - Liquids EUR (Mbbl): 528
  - Sales Gas EUR (Bcf): 4.3
  - UI Rec (Mboe): 1,244
  - % Liquids: 42%
  - C5+ (bbl/MMcf): 8
  - C2-C4 (bbl/MMcf): 8
  - Capital ($MM): $4.6
  - C* ($MM): $11.0

- **Iron Bridge**
  - BT-NPV@10% (MM): $6.3
  - IRR (%): 114%
  - Payout (yrs): 1.0
  - P/I (@10%): 1.1
  - IP: 363 (bbl/d)
  - Liquids EUR (Mbbl): 336
  - Sales Gas EUR (Bcf): 3.7
  - UI Rec (Mboe): 960
  - % Liquids: 35%
  - C5+ (bbl/MMcf): 10
  - C2-C4 (bbl/MMcf): 12
  - Capital ($MM): $5.7
  - C* ($MM): $11.3

---

*Montney Trailblazing* is well underway by Hammerhead, Iron Bridge, and Velvet, as they push the tight-oil fairway to the northeast.

- Inception 11-13 IP(20): 208 bbl/d oil, 1.4 MMcf/d gas
- Velvet 01-10 IP(20): 486 bbl/d oil, 1.3 MMcf/d gas
- Shell 15-12-67 SW6 IP(20): 2.5 MMcf/d & 227 bbl/MMcf

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Note: Based on flat price deck with US$60/bbl WTI and C$2.00/GJ AECO, USD/CAD = 1.25; -C$3.81/bbl diff to Edm Light

(1) BMO Equity Research Report Oct 2017: Montney Trailblazing: Extending the Oil Limits at Gold Creek
Karr Volatile Oil/Oil-Rich Gas - Early Days Promising

Emerging Tight-oil at Karr - Volatile Oil with Significant Potential

17 permits or drilling
7 wells confidential

Light Oil
Volatile Oil
Rich Gas
Lean Gas
Dry Gas

R5 R4 R3 R2 R1W6 R27W5

T67 T66 T65 T64 T63 T62

Kakwa
Karr

Hammerhead
Stacked Horizontals (Δ180 m)
15-03 (Upr) CTD 52 Mbbl
16-03 (Lwr) CTD 20 Mbbl

100/03-22-066-03W6/00 Vertical Type Log

Type Log - over 200 m Section, Evident Porosity Throughout

100/03-22-066-03W6/00
GULF AEC KARR 3-22-66-3

Upper Montney

Middle Montney

Current targets are the Upper and Middle Montney

Future Potential with testing and delineation of Lower Montney

3% Limestone Porosity
40 ohm Resistivity

Multiple producible horizons in the Upper and Lower Montney
Newest results suggest an emerging prolific oil-producing area

Source: geoSCOUT, BMO Capital Markets
Hammerhead, XTO, and Husky are Playing at Karr

Preliminary results at Karr suggest the area may be similar to, and perhaps as lucrative as, Gold Creek.

Note: Based on flat prices with US$60/bbl WTI and C$2.00/GJ AECO, USD/CAD = 1.25; -C$3.81/bbl diff to Edm Light
Improved completion methods such as longer laterals, more proppant, and tighter frac stage spacing optimize deliverability.

Conservative completion design at Gold Creek prevents fracing into the upper water-bearing interval.
Drill and Completion Cost Compression Magnifies Value

Drilling Costs ($MM)

Completion Costs ($MM)

Drill & Complete Costs ($MM)

Improved Completion Methods Optimize Deliverability

- **Longer Lateral Length**
  Average completed lateral lengths have increased by almost 900 m; Top two longest completed lengths >5,000 m

- **Tighter Frac Spacing**
  Frac spacing has significantly decreased from an average of 150 m to 75 m resulting in increased number of stages from <15 to >35

- **Increased Proppant Placed**
  In every area except Gold Creek, proppant tonnage has significantly increased from an average of ~800 t to >8,000 t

*Costs have remained flat despite significant increases in lateral lengths and proppant placement*

Source: geoSCOUT, BMO Capital Markets, Verdazo Analytics, geoLOGIC Well Completions & Frac Database, Company Corporate Presentations
Note: Based on flat prices with US$60/bbl WTI and C$2.00/GJ AECO, USD/CAD = 1.27; C$3.81/bbl diff to Edm Light
Type Curves Reflect Wide Spectrum of Thermal Maturity and Operator

Generalized Thermal Maturity with TC area references

- Encana Pipestone VO IRR 358%
- NuVista Rich CND IRR 61%
- Blackbird Rich CND/VO IRR 88%
- Hammerhead Base IRR 109%
- Iron Bridge VO IRR 114%
- Hammerhead Sweet Spot IRR >500%
- Hammerhead Karr Base/Optimized IRR 45%/129%
- Seven Generations Nest 1 IRR 82%
- NuVista NW Elmcworth IRR 44%
- NuVista NE Gold Creek IRR 58%
- Paramount Wapiti IRR 73%
- NuVista S Bilbo IRR 109%
- Paramount Karr South West IRR 90%
- Paramount Karr South East IRR 66%
- Seven Generations Nest 2 IRR 276%
- Seven Generations Nest 3 IRR 124%

Tightly Held Lands throughout the Alberta Fairway

Land Positions:
- Advantage
- Blackfoot
- Canadian Natural
- Cenovus
- Encana
- Enbridge
- Hammerhead
- Hecla
- Iron Bridge
- K&M Horse Oil
- Midstream
- Paramount
- Sequoia
- Seven Generations
- Sinopec
- Shell
- Suncor
- Tourmaline
- Nexen
- NOC
Robust Returns Can Be Made in the Alberta Liquids-Rich Montney Plays

Internal Rate of Return (%) across the Alberta Montney Fairway

Operators are applying advanced drilling and completions techniques resulting in 2X and even 3X the return on Base Type Curves
What to Watch for in the Alberta Liquids-rich Montney...

Moving Forward

- The demand for Alberta pentanes plus is expected to increase due to forecast growth in non-upgraded bitumen. If development of these ultra-rich plays does not meet demand, Alberta will have to increase imports of pentanes plus over the next 10 years to meet the forecasted shortfall between the availability of, and demand for, diluent.
- The future demand for pentanes plus coupled with light oil pricing and the robust economics at today’s commodity prices, results in aggressive development programs by many of the operators within the liquids-rich/volatile-oil fairways.

Elmworth

- Recent well results of this extensively-drilled area have exceeded liquids expectations.
- Operators are drilling multi-well pads and implementing ‘W’ pattern well placement which has resulted in reduced capital and increased recoveries.
- Parent - child well performance interference (due to less efficient early completion techniques) may begin to affect certain wells.
- Operators are implementing reservoir management strategies including artificially managing initial gas rates to maintain reservoir energy for optimized long-term well performance, specifically condensate production.
- Initial well results of the Lower Montney are very promising.

Kakwa

- Advanced completion techniques have resulted in top performing wells.
- Seven Generations activity and impressive initial results are extending the play to the south of their aggressively developed Nest 2 area.
- Will the Lower Montney play double the locations of the Upper/Middle Montney?

Gold Creek

- Appropriate wellbore positioning and completion design is key to prevent fracturing into the water-bearing interval at the top of the Montney, however some operators are considering fracturing into it and using it as a pressure support mechanism.
- Gas-Oil ratios are highly variable; further delineation of the play will determine whether this is due to rock quality, thermal maturity, completion design, and/or well orientation.

Pipestone

- Operators continue to delineate their land extending the play into uncharted territory.
- Curiosity is at its peak as we wait patiently for wells to come off confidential status.
- The high condensate ratios in the ultra-rich and volatile-oil fairways are some of the best in WCB.
- New generation well completions are showing extraordinary initial well results.
- Will Encana drill a double-digit multi-well cube in Pipestone?

Karr

- Karr has received minimal development capital in the past and has significant running room with potential to extend the tight-oil fairway to the east and south.
- Future drilling will determine whether the optimized completion design will result in the expected increase in well performance.
- Watch for results from the first Lower Montney wells as some have recently come off confidential status.

Plenty more treasure to be discovered!
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