Presentation Outline

• Current oil transportation dynamics
  • Understanding current and future oil production
    – Pricing update
    – Activity
    – Oil forecasts
  • North Dakota natural gas production
    – Flaring and gas capture
    – Natural gas liquids
• Pipeline construction update
<table>
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<th>MONTH</th>
<th>ND</th>
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<td>3,449</td>
<td>1,249,170</td>
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<td>December</td>
<td>1,181,319</td>
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</table>
Estimated Williston Basin Oil Transportation

- Estimated Rail
- Estimated Pipeline Export
- Refined
- Truck to Canadian Pipelines
- Brent - WTI Spread (EIA)
Estimated ND Rail Export Volumes

Barrels Per Day

Presentation Outline

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  – Natural gas Liquids

• Pipeline construction update
North Dakota Oil Differential

Source: EIA First Purchase Price
Bakken Breakeven Analysis

Important Considerations

• Breakeven areas were determined by neighboring well performance and are expected to expand as new completion technology is applied in areas outside “the core.”

• Just because an area is considered “economic” does not mean that it is the most economic option for the industry participant(s). Competition for capital continues to exist inside and outside the region.
Bakken Breakeven Price Range (20% IRR)

Bakken Breakeven Prices
$6 - $8 Million
Completed Wells Cost

- $58-$73
- $49-$61
- $43-$52
- $39-$48
- $36-$43
- $34-$40
- $32-$38
- $28-$33
- $26-$30

Background Map: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
### Bakken Breakeven Economics

#### County/Regional Analysis

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<tr>
<th>Breakeven Range</th>
<th>Billings Area mi²</th>
<th>Burke Area mi²</th>
<th>Divide Area mi²</th>
<th>Dunn Area mi²</th>
<th>Fort Berthold Area mi²</th>
<th>Golden Valley Area mi²</th>
<th>McKenzie Area mi²</th>
<th>Mclean Area mi²</th>
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</table>

#### Ft. Berthold

- **Yes**
- **No**

*Breakeven Range Included: $6mm, $7mm, $8mm Well Costs*
44% Economic Area Increase 2017 to 2018

Peak 30-Day Production Level / Wellhead Breakeven Range (20% IRR)

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<th>2017 Range</th>
<th>2016 Range</th>
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Drilling Locations* – January 22, 2018

Bakken Breakeven Prices
$6 - $8 Million

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<th>Color</th>
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<td>$49-$61</td>
<td>Green</td>
</tr>
<tr>
<td>$58-$73</td>
<td>Green</td>
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</tbody>
</table>

*Due to confidential status, the target production zone for many wells is unknown.

Background Map: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.
Forecasting Challenges: Activity vs. Price

[Graph showing the relationship between well completions and spuds vs. WTI price by year from 2012 to 2017.]
North Dakota Forecast Activity Assumptions

- ND New Wells Case 1
- ND New Wells Case 2

NDPA Forecast

JJ Kringstad - North Dakota Pipeline Authority
North Dakota Oil Production Forecast

- NDPA Oil Forecast: Case 1
- NDPA Oil Forecast: Case 2
Williston Basin Oil Production & Export Capacity, BOPD

Production forecast is for visual demonstration purposes only and should not be considered accurate for any near or long term planning.

JJ Kringstad - North Dakota Pipeline Authority
Presentation Outline

• Current oil transportation dynamics
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  – Activity
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  – Flaring and gas capture
  – Natural gas liquids

• Pipeline construction update
NDPA ND Gas Production Forecast

Natural Gas Production, MMCFD

- ND Gas Case 1 - MMCFD
- ND Gas Case 2 - MMCFD

JJ Kringstad - North Dakota Pipeline Authority
Solving the Flaring Challenge

**Simple Terms**

- **Blue** – Lack of pipelines
- **Orange** – Challenges on existing infrastructure

**GREEN** – % of gas captured and sold

**Blue** – % flared from zero sales wells

**Orange** – % flared from wells with at least one mcf sold.

**Statewide**

- 88%
- 10%
- 2%

Dec 2017 Data – Non-Confidential Wells
North Dakota Captured* NGL’s

*Non-flared NGL’s & Assumes 10 GPM
Major NGL Pipeline and Processing Infrastructure
ONEOK Elk Creek NGL Pipeline

**Project Highlights**
- 900 Miles - 20” Pipeline
- $1.4 Billion
- 240,000 BPD Capacity
- Expandable to 400,000 BPD
- End of 2019 Proposed Completion
- Y-Grade Transportation
Solving the Flaring Challenge

- Suspended Plant Capacity
- Planned Plant Capacity
- Existing Plant Capacity
- NDPA Case 1 Forecast
- NDPA Case 2 Forecast
- Historical Sold, MMCFD
- Historical Flared, MMCFD

Targets Case 1 (Sold)
Targets Case 1 (Flared)

91% Q4-20
88% Q4-18
85% Q4-16
80% Q2-16
77% Q1-15
74% Q4-14

JJ Kringstad - North Dakota Pipeline Authority
Major Gas Pipeline and Processing Infrastructure
Northern Border Pipeline

- 42” Pipeline
- Carries Canadian (Port of Morgan) and Domestic Gas
- Receives Gas From ND Plants, WBI Transmission Interconnections, and WY Pipelines (Bison & Grasslands)
- Midcontinent Deliveries
Conclusion: **IF** no other gas export options open and all other deliveries on other pipelines stay static, ND gas production could increase 1.58-1.88 BCFD (from Nov-17) before Northern Border is 100% Bakken production. BTU management becomes increasingly important for Bakken residue gas.
Presentation Outline

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• Pipeline construction update
North Dakota Pipeline Construction

- New Miles
- Year End Miles

Sources: NDIC & PHMSA

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<th>Year End Miles</th>
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<tr>
<td>2016</td>
<td>914</td>
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Total Miles of Pipe: 26,353

Sources: NDIC & PHMSA
North Dakota Pipeline Construction

### Gathering
- **2011**: 917 miles, 379 gas, 248 oil, 313 produced water, 136 gas transmission, 313 petroleum transmission
- **2012**: 1,608 miles, 965 gas, 380 oil, 380 produced water, 180 gas transmission, 380 petroleum transmission
- **2013**: 910 miles, 765 gas, 485 oil, 485 produced water, 192 gas transmission, 485 petroleum transmission
- **2014**: 948 miles, 538 gas, 609 oil, 609 produced water, 192 gas transmission, 609 petroleum transmission
- **2015**: 659 miles, 547 gas, 661 oil, 661 produced water, 192 gas transmission, 661 petroleum transmission
- **2016**: 136 miles, 180 gas, 192 oil, 192 produced water, 192 gas transmission, 192 petroleum transmission

### Transmission
- **2011**: 143 miles, 313 gas, 202 oil, 202 produced water, 3 petroleum transmission
- **2012**: 77 miles, 591 gas, 202 oil, 202 produced water, 3 petroleum transmission
- **2013**: 9 miles, 302 gas, 202 oil, 202 produced water, 3 petroleum transmission
- **2014**: 3 miles, 403 gas, 202 oil, 202 produced water, 3 petroleum transmission

Sources: NDIC & PHMSA
New Miles and Well Completions

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<th>Year</th>
<th>New Miles of Pipe</th>
<th>Well Completions</th>
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<td>1,539</td>
</tr>
<tr>
<td>2016</td>
<td>914</td>
<td>738</td>
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</table>
2008 6,262 mi²
2009 6,493 mi²
2010 9,866 mi²
2011 13,735 mi²
2012 16,267 mi²
2013 13,428 mi²
2014 12,053 mi²
2015 8,433 mi²
2016 4,206 mi²
2017 YTD 3,578 mi²

2 Mile Buffer Around New Wells By Year
New Miles and Activity Footprint

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<th>Square Miles</th>
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<td>2016</td>
<td>3,578</td>
<td>4,206</td>
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</table>

*2017 Forecasted

JJ Kringstad - North Dakota Pipeline Authority
Predicting New Miles With Activity Footprint
Contact Information

Justin J. Kringstad, Director
North Dakota Pipeline Authority

600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

Phone: (701)220-6227
Fax: (701)328-2820
E-mail: jjkringstad@ndpipelines.com

Websites:
www.pipeline.nd.gov
www.northdakotapipelines.com
Objective
Define where the Bakken/Three Forks system may be economic in the current oil price environment.

Method
Analyze past well performance across the region and estimate well economics for various production levels.

Disclaimer
The goal of this work is not to imply individual company actions or intentions. All view expressed are strictly that of Justin J. Kringstad.

Neither the State of North Dakota, nor any agency, officer, or employee of the State of North Dakota warrants the accuracy or reliability of this product and shall not be held responsible for any losses related to its use.
Key Economic Assumptions

- $6-$8 Million Well Costs
- $59/BBL & $5.00/MCF Wellhead Pricing
- 1/6 Royalty
- Zero Flaring
- Assumed 10-20% IRR to drill (calculated after production taxes and royalties)
- No Tax Incentives Included
- Production rate is 30-day average
- All Bakken/Three Forks wells drilled in 2008+
Peak Month Minimum
400 BOPD

Peak Month Well Production, BOPD

<table>
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<tbody>
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<tr>
<td>8 MM</td>
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Breakeven Wellhead Price (AT IRR of 20%)

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<th>$10</th>
<th>$20</th>
<th>$30</th>
<th>$40</th>
<th>$50</th>
<th>$60</th>
<th>$70</th>
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</table>

$59 Wellhead
Peak Month Minimum 500 BOPD

- Peak Month Well Production, BOPD
- 5,691 Wells
- $59 Wellhead

After Tax IRR

- $59 Wellhead

Breakeven Wellhead Price (AT IRR of 20%)
Peak Month Minimum
600 BOPD
Peak Month Minimum
700 BOPD

Peak Month BOPD / Well Cost

$59 Wellhead

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Peak Month Minimum
800 BOPD

Peak Month BOPD / Well Cost
800

After Tax IRR

6 MM
7 MM
8 MM

Breakeven Wellhead Price (AT IRR of 20%)
$0 $5 $10 $15 $20 $25 $30 $35 $40 $45

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JJ Kringstad - North Dakota Pipeline Authority

Peak Month Well Production, BOPD
1,924 Wells

$59 Wellhead
Peak Month Minimum 900 BOPD

Peak Month Well Production, BOPD

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Break-even Wellhead Price (AT IRR of 20%)

After Tax IRR

6 MM
7 MM
8 MM

$59 Wellhead
Peak Month Minimum
1,000 BOPD

Peak Month Well Production, BOPD

<table>
<thead>
<tr>
<th>Well Cost</th>
<th>Breakeven Wellhead Price (AT IRR of 20%)</th>
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<td>$20 - $35</td>
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$59 Wellhead
Peak Month Minimum
1,250 BOPD

Peak Month BOPD / Well Cost
1250

After Tax IRR

$59 Wellhead

Breakeven Wellhead Price (AT IRR of 20%)
Peak Month Minimum 1,500 BOPD

Peak Month Well Production, BOPD

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Breakeven Wellhead Price (AT IRR of 20%)

© OpenStreetMap contributors
Summary of $59 Wellhead Oil

Peak Month BOPD / Well Cost

After Tax IRR

Assumed Range of Minimum Acceptable Rate of Return

400 500 600 700 800 900 1000 1250 1500

650% 600% 650% 500% 550% 500% 450% 400% 350% 300% 250% 200% 150% 100% 50% 50%
Breakeven Summary

Peak Month Well Production, BOPD / Well Cost

Breakeven Wellhead Price (AT IRR of 20%)
Contact Information

Justin J. Kringstad, Director
North Dakota Pipeline Authority

600 E. Boulevard Ave. Dept. 405
Bismarck, ND 58505-0840

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