NDPA Bulk Slides

Justin J Kringstad
Geological Engineer
Director
North Dakota Pipeline Authority

August 30, 2018

Presentation Outline

- **Economics**
- Current Activity and 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

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.

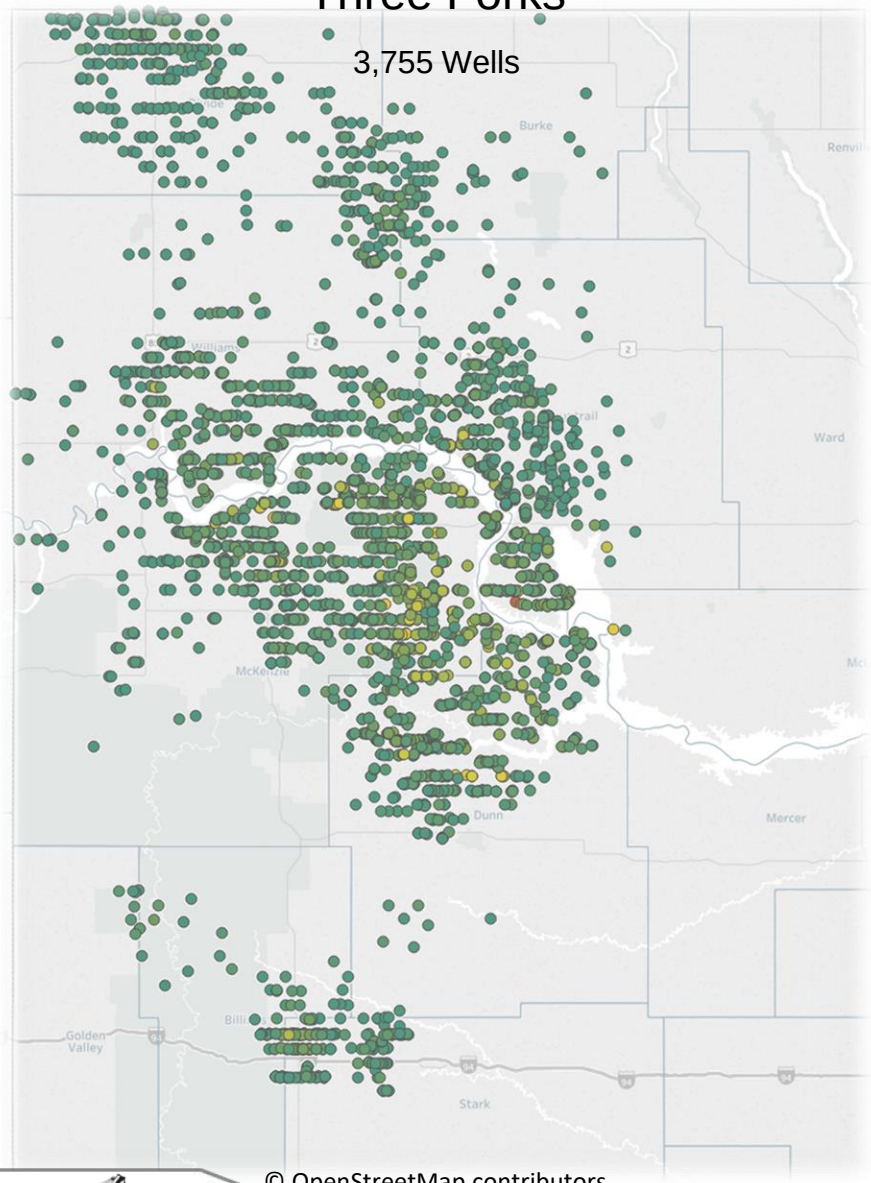
Key Economic Assumptions

- $6-$8 Million Well Costs
- $63/BBL & $6.00/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 - 200 BOPD

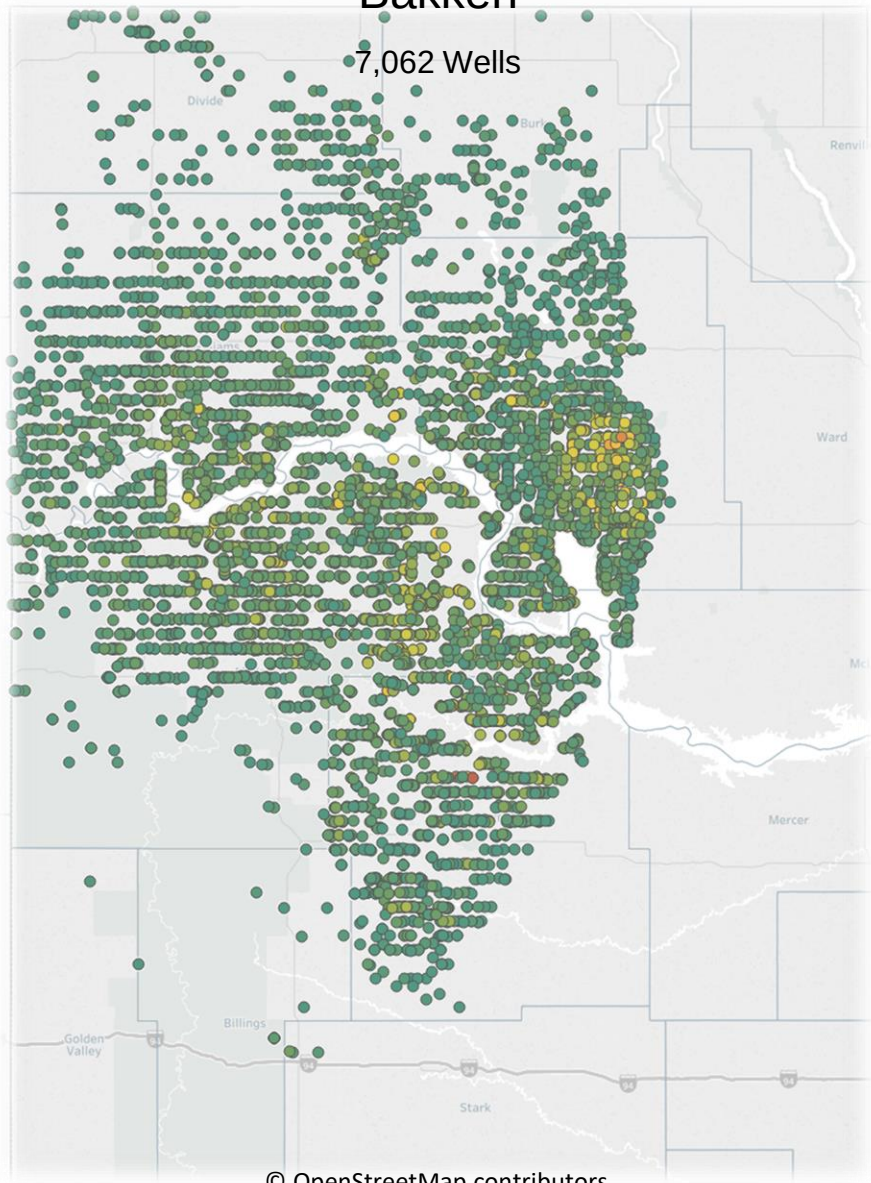
Three Forks

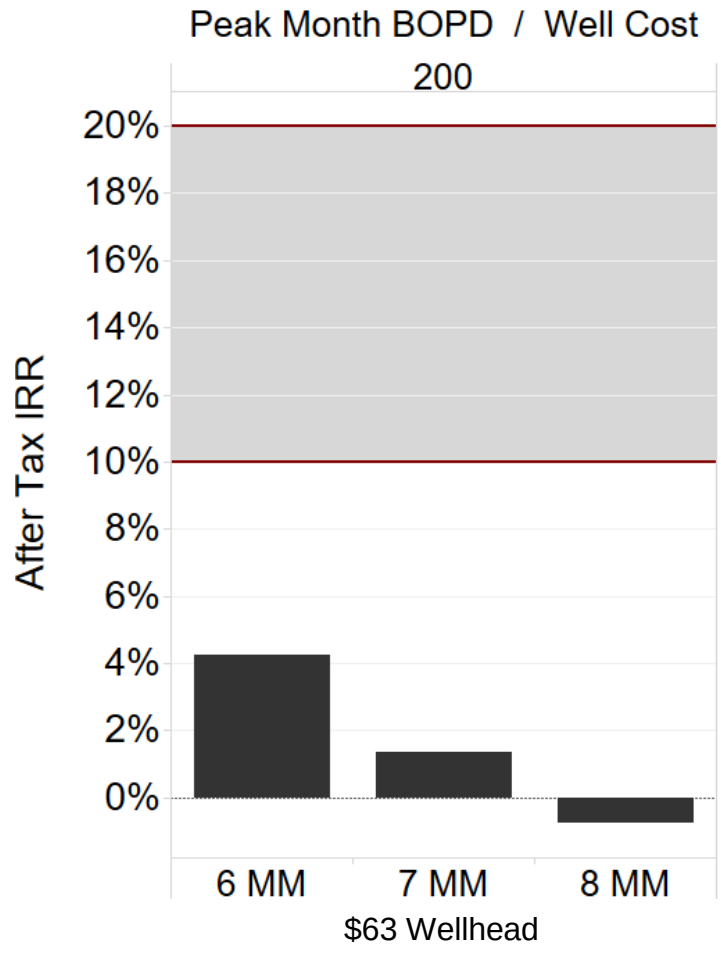
3,755 Wells

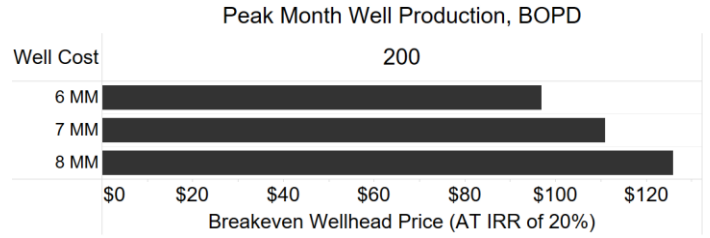


Bakken

7,062 Wells



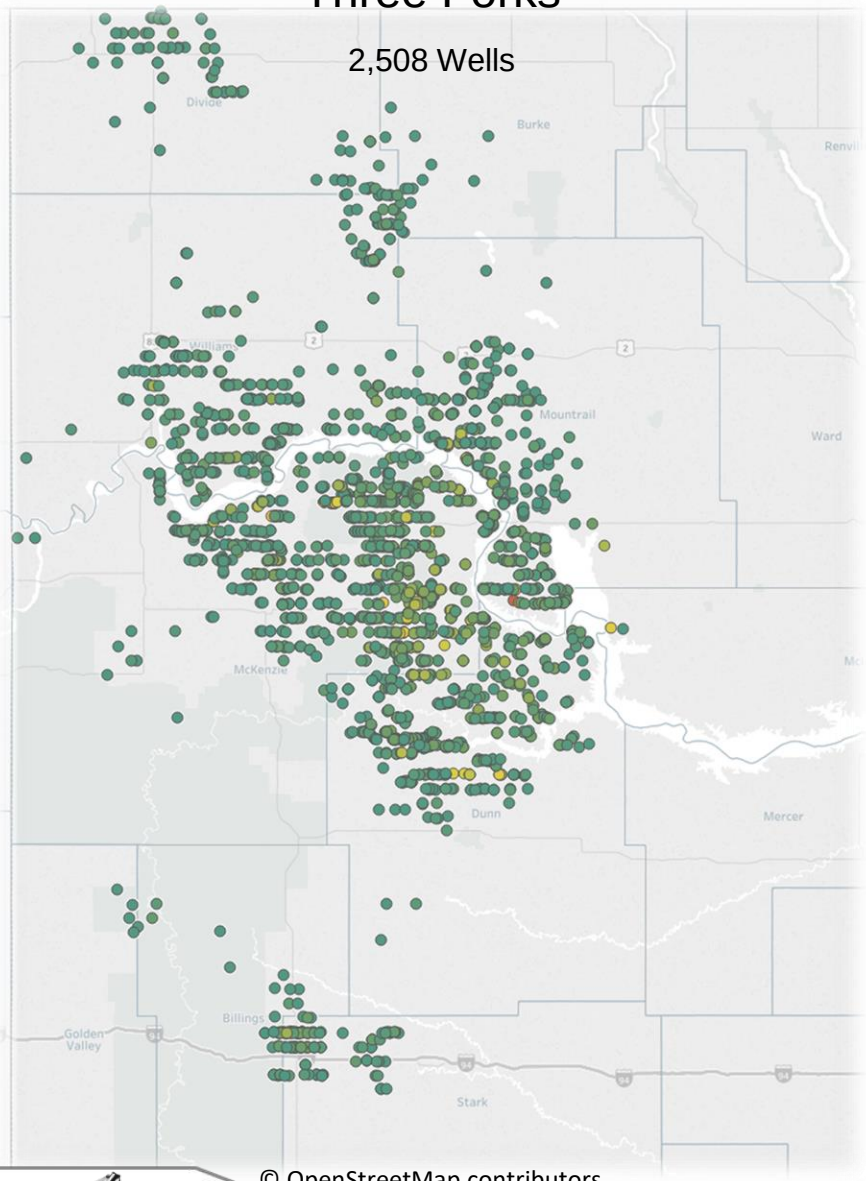




Peak Month Minimum - 400 BOPD

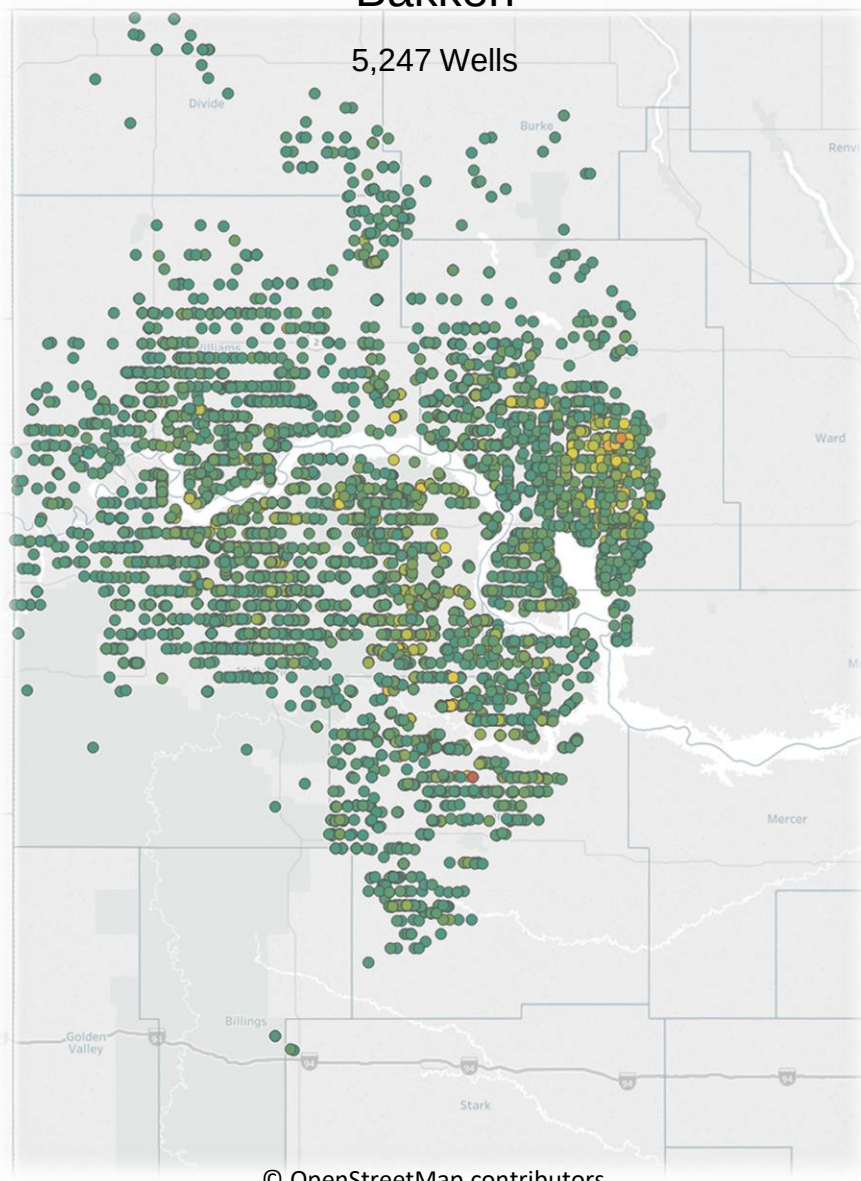
Three Forks

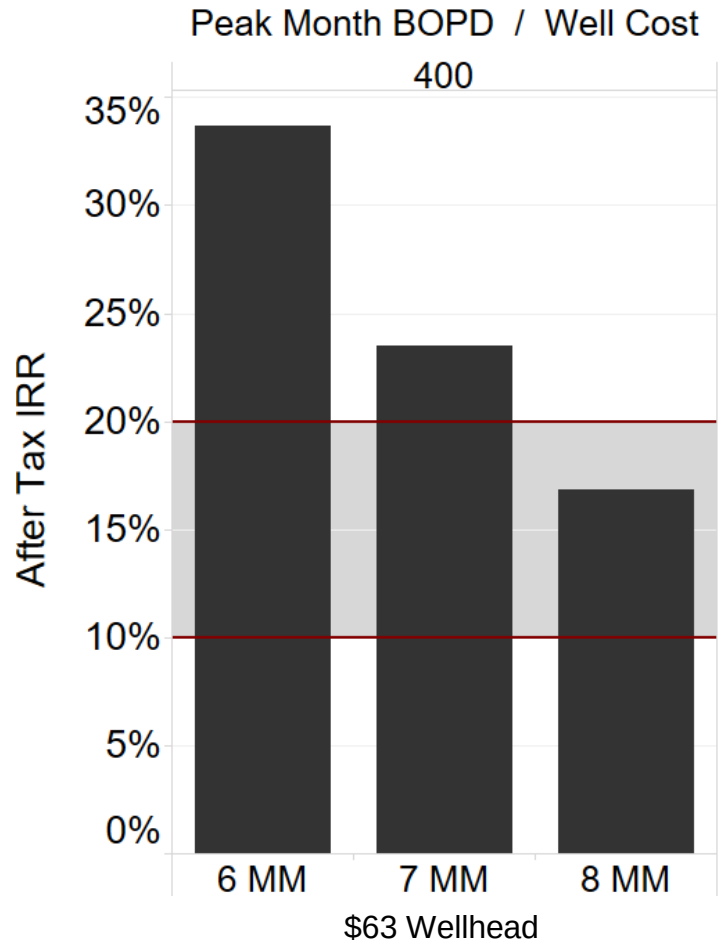
2,508 Wells

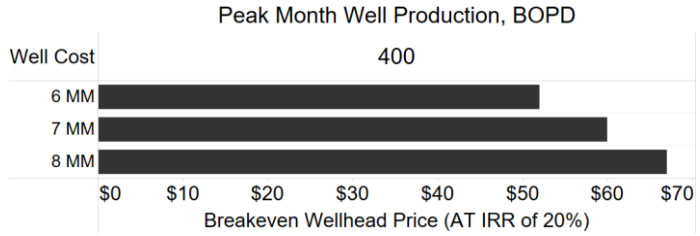


Bakken

5,247 Wells



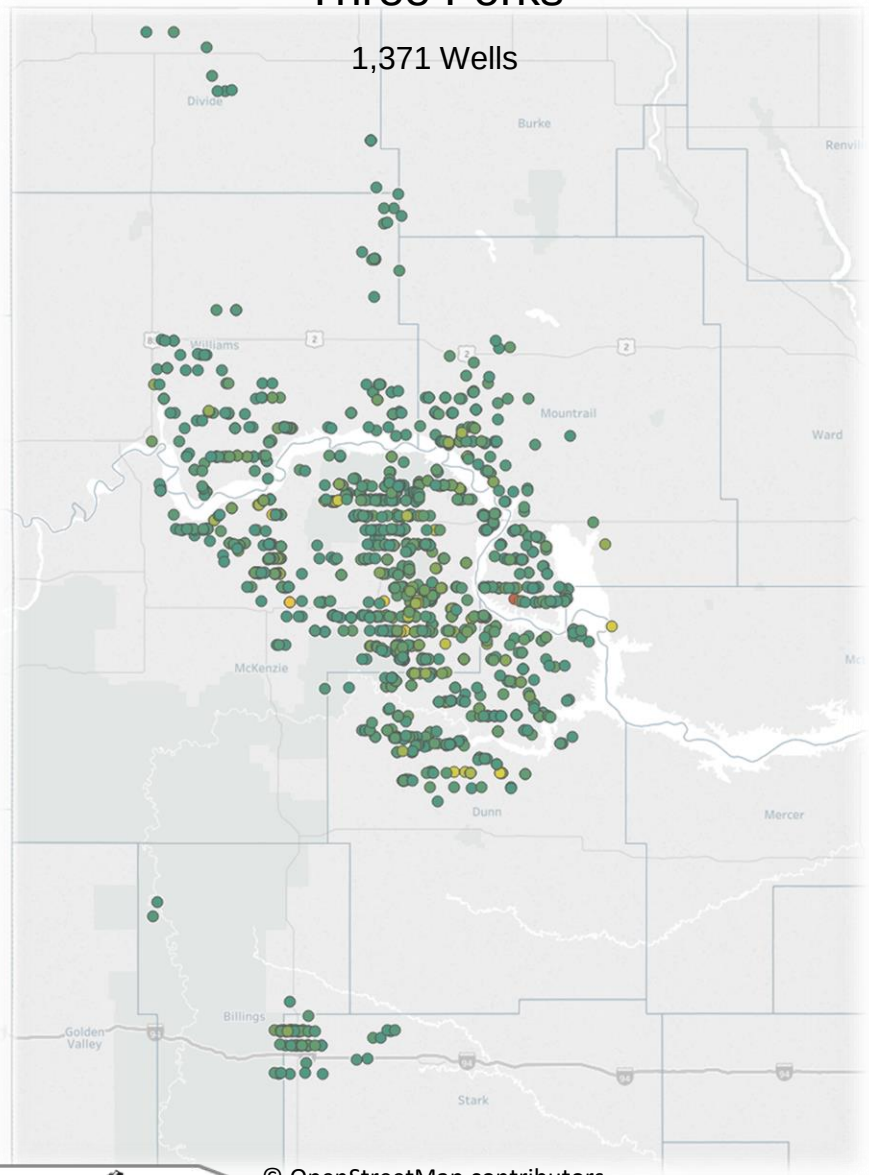




Peak Month Minimum - 600 BOPD

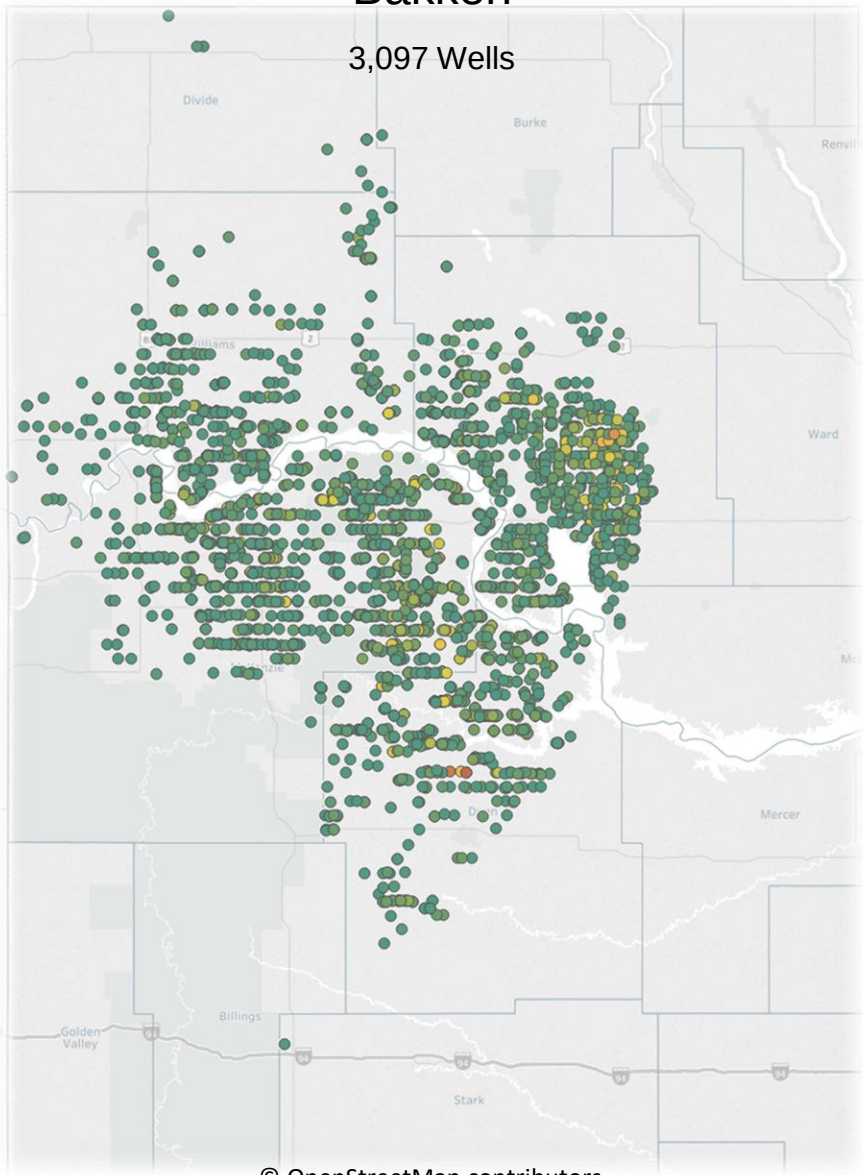
Three Forks

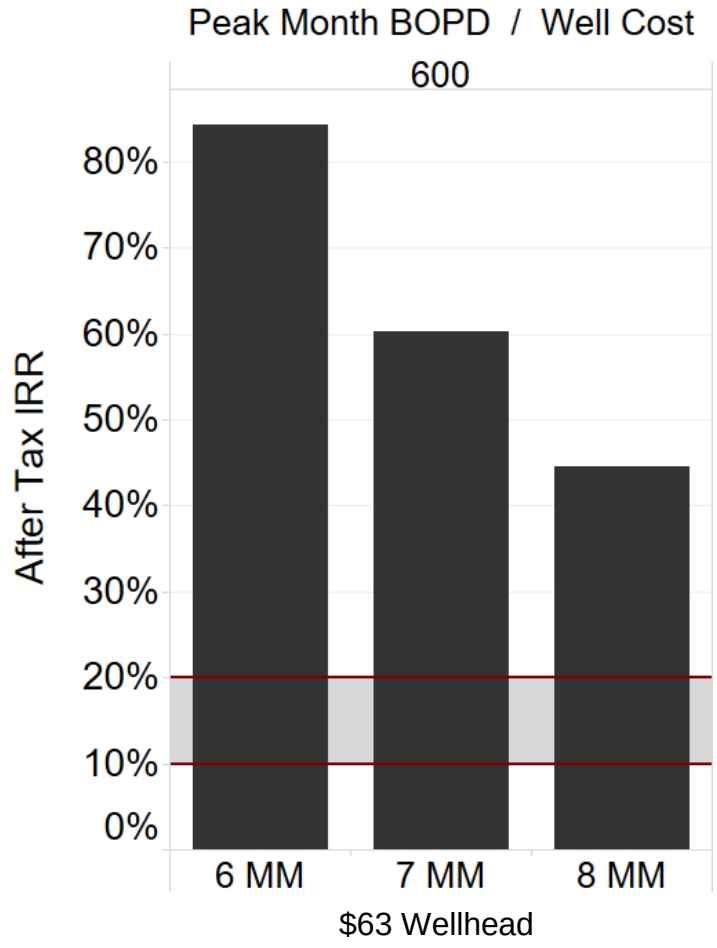
1,371 Wells

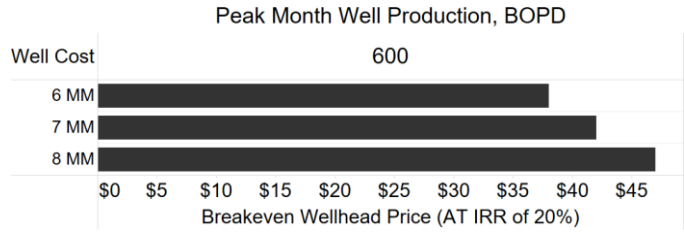


Bakken

3,097 Wells



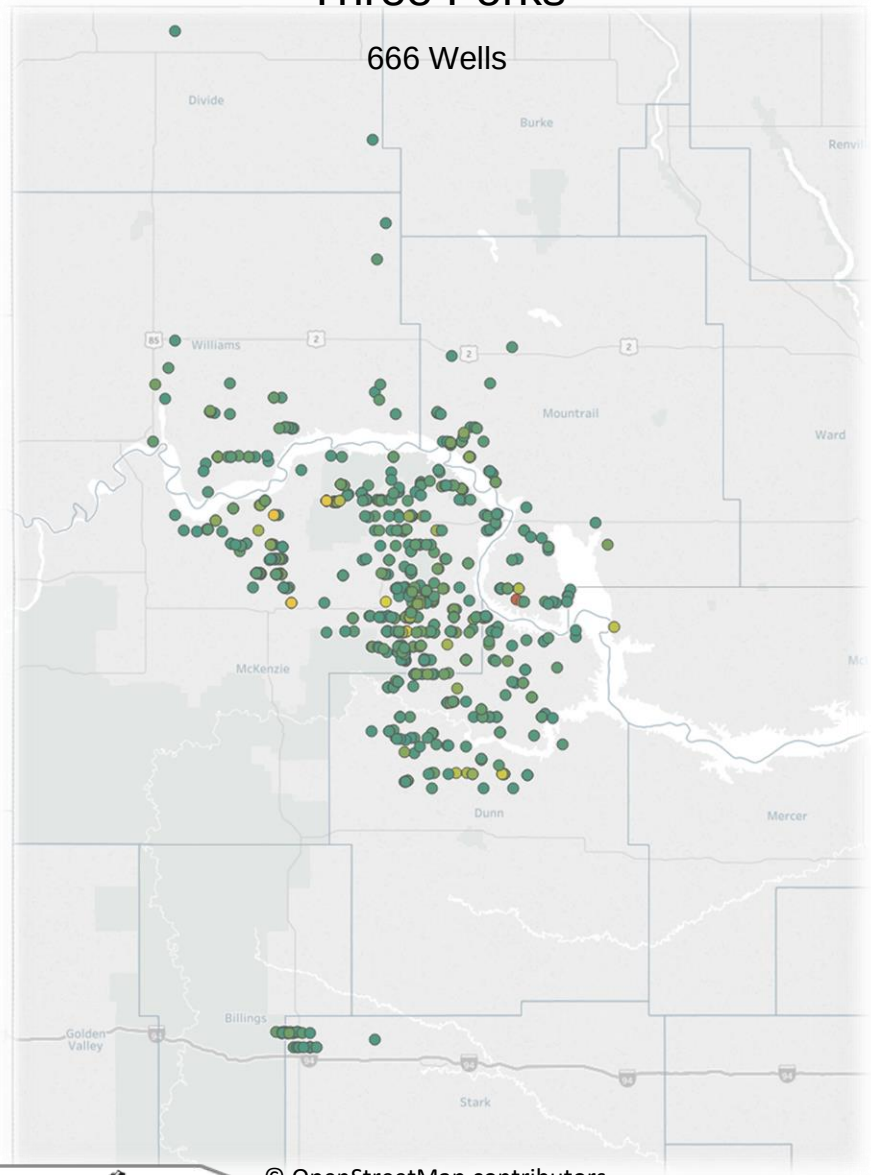




Peak Month Minimum - 800 BOPD

Three Forks

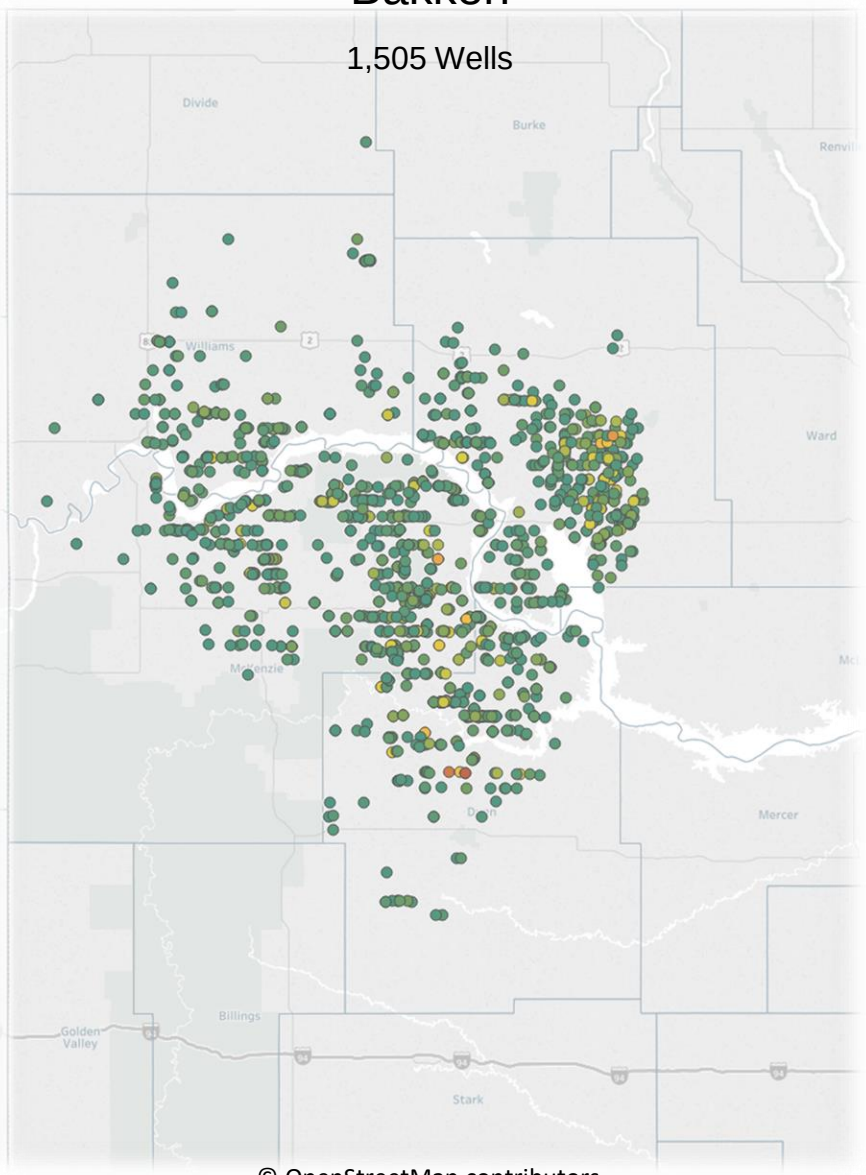
666 Wells



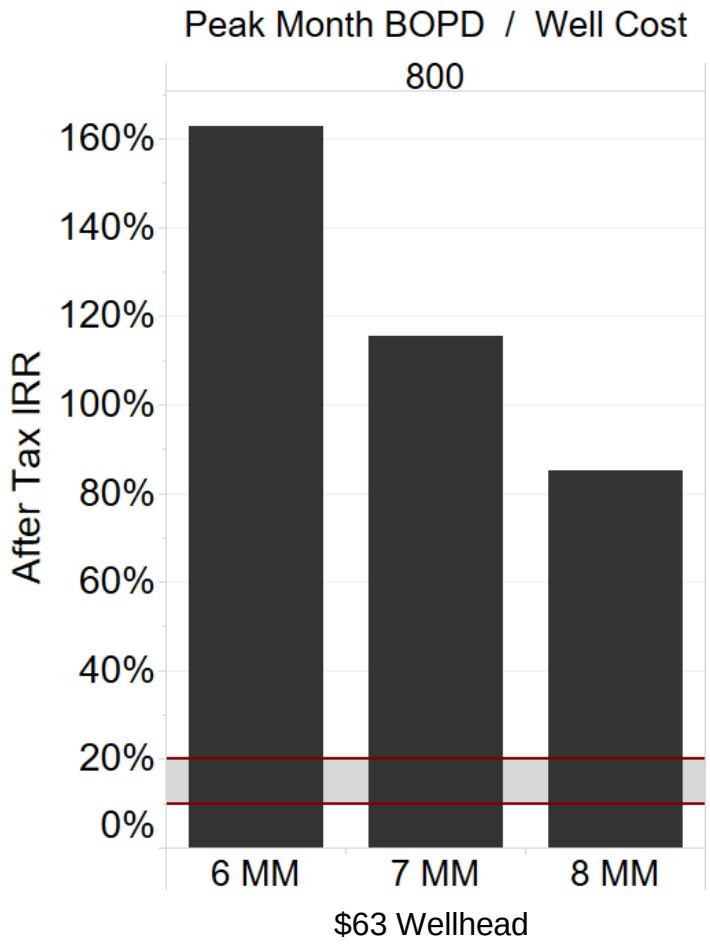
© OpenStreetMap contributors

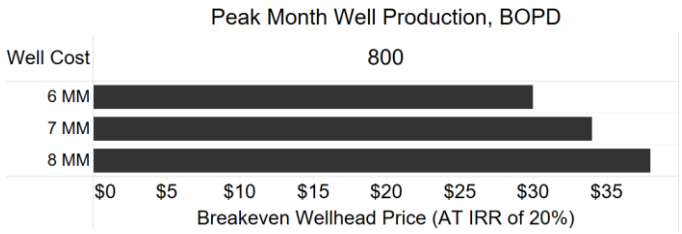
Bakken

1,505 Wells



© OpenStreetMap contributors

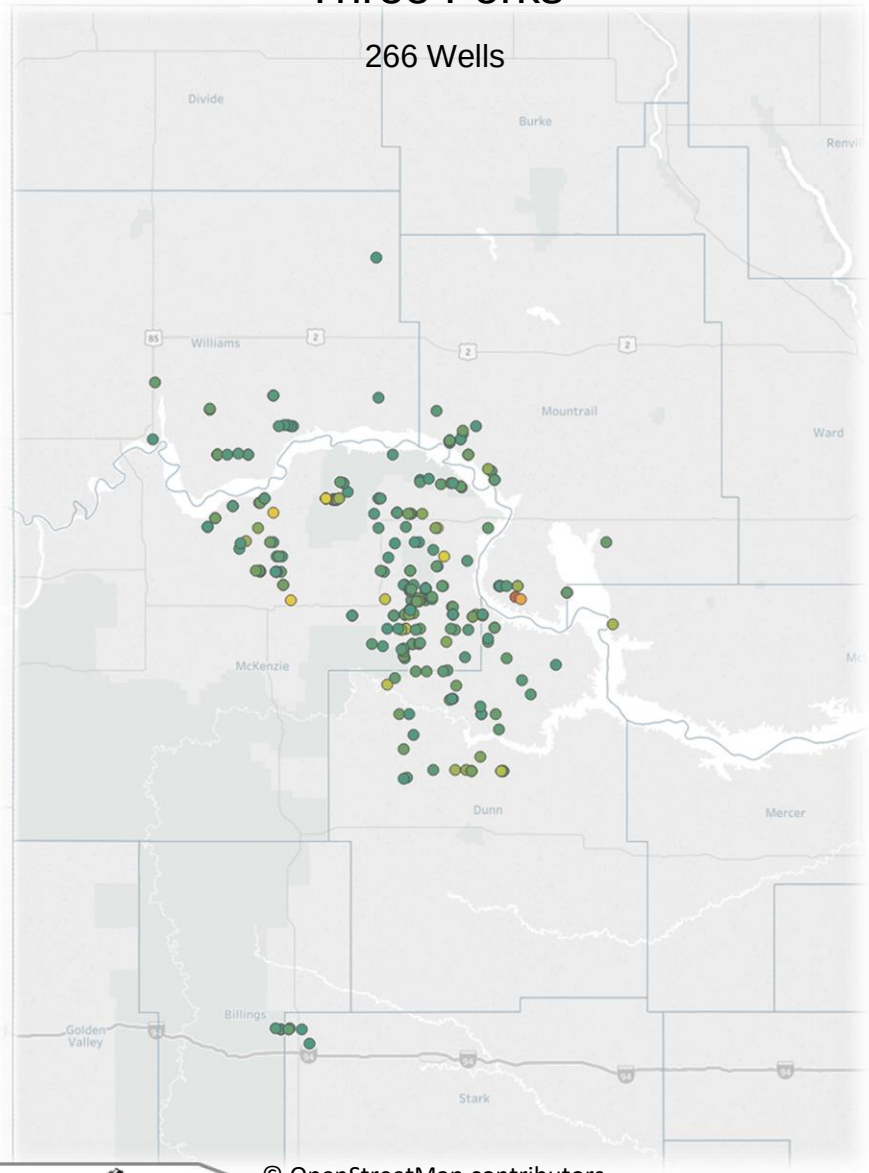




Peak Month Minimum – 1,000 BOPD

Three Forks

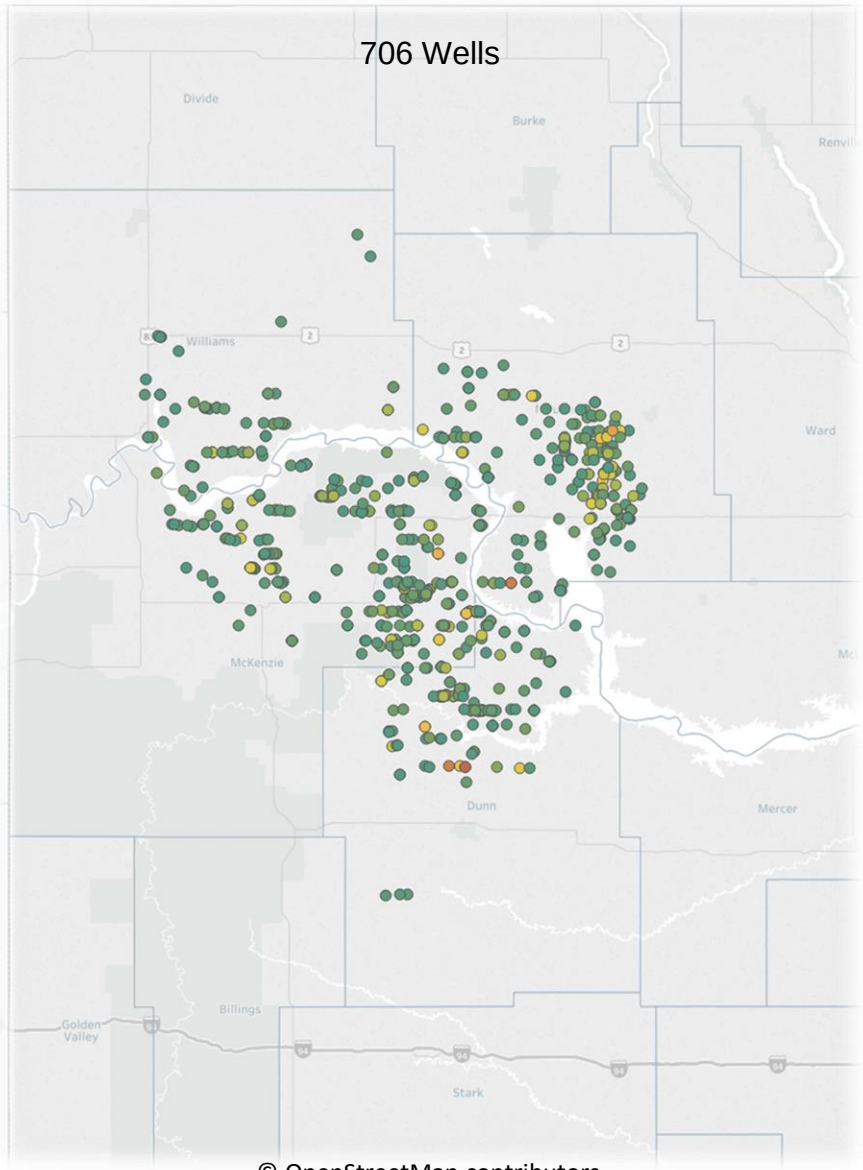
266 Wells



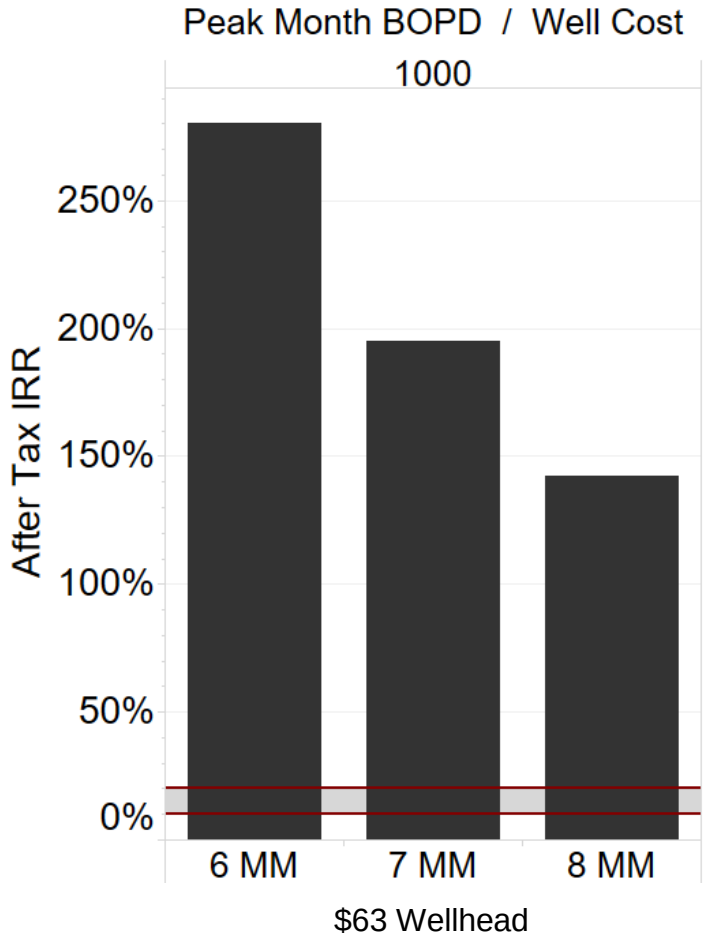
© OpenStreetMap contributors

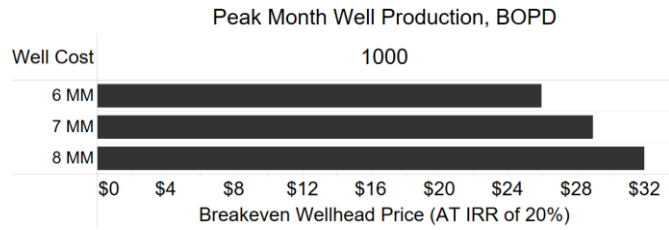
Bakken

706 Wells



© OpenStreetMap contributors

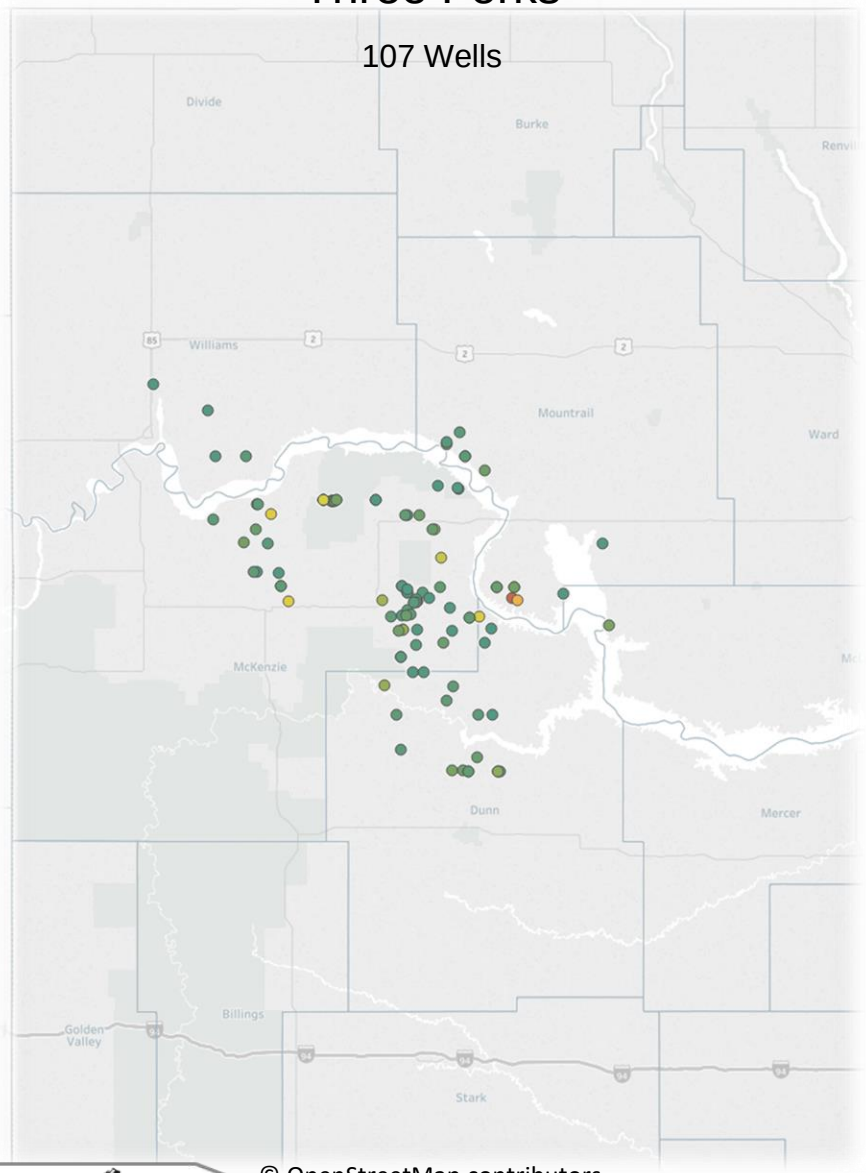




Peak Month Minimum – 1,250 BOPD

Three Forks

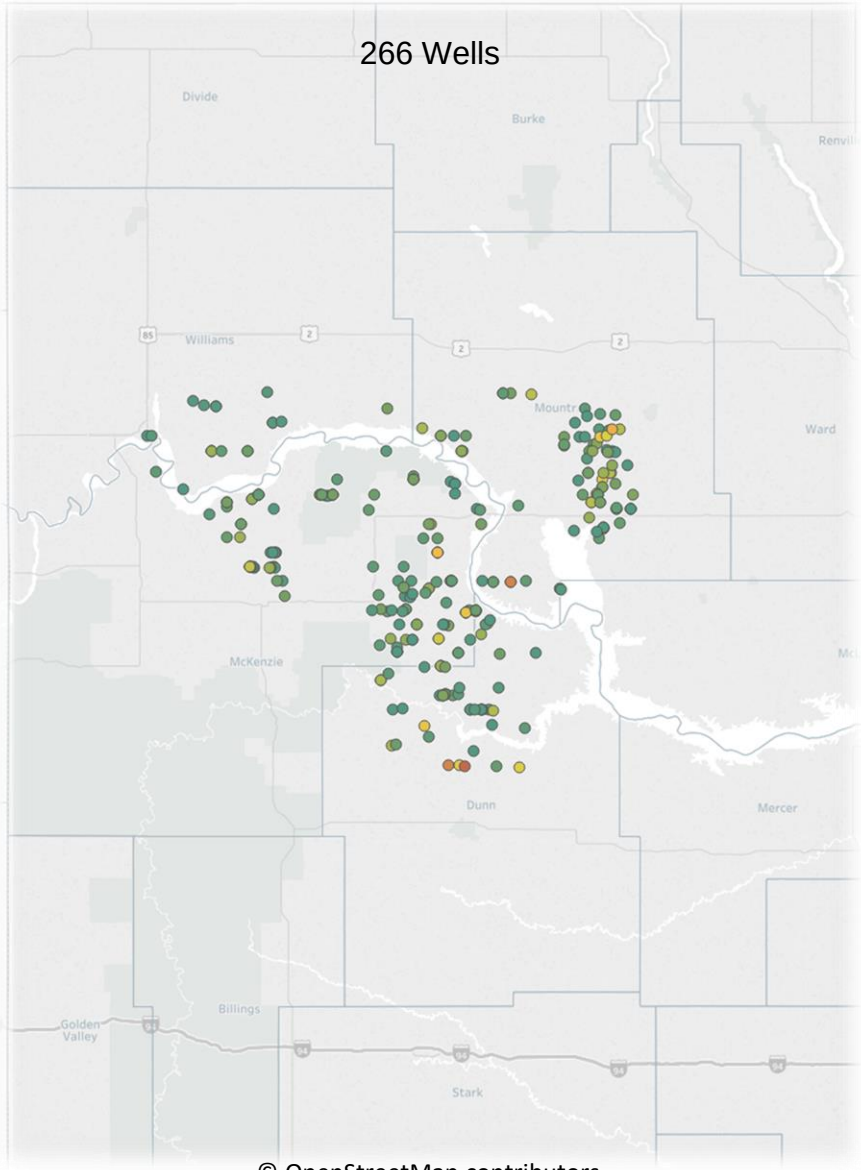
107 Wells



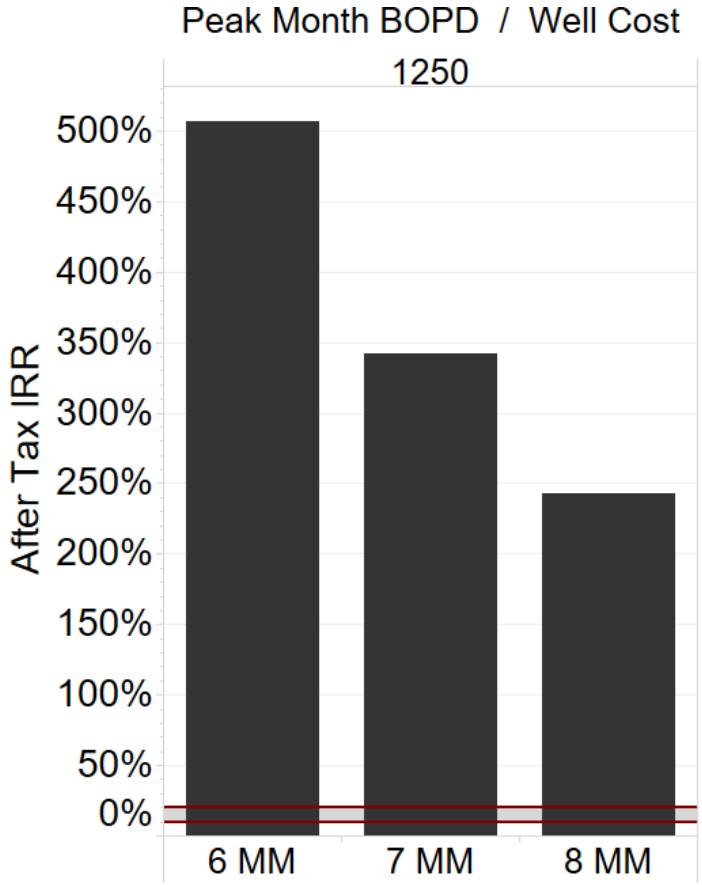
© OpenStreetMap contributors

Bakken

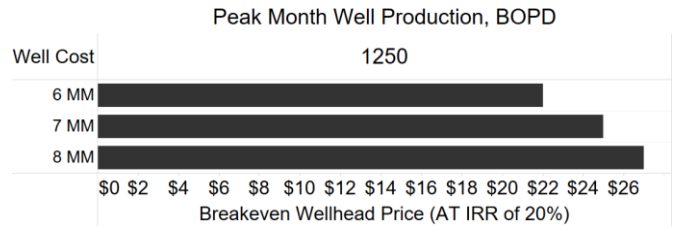
266 Wells



© OpenStreetMap contributors



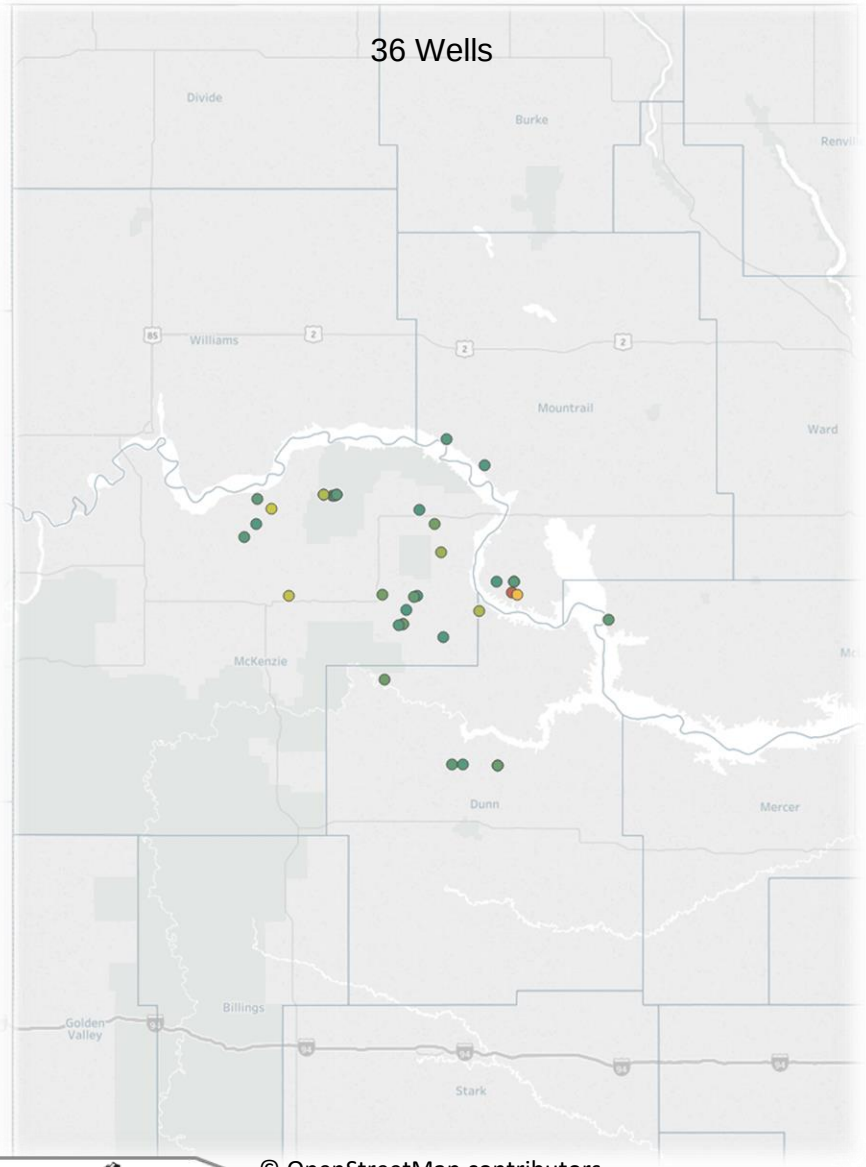
$63 Wellhead



Peak Month Minimum – 1,500 BOPD

Three Forks

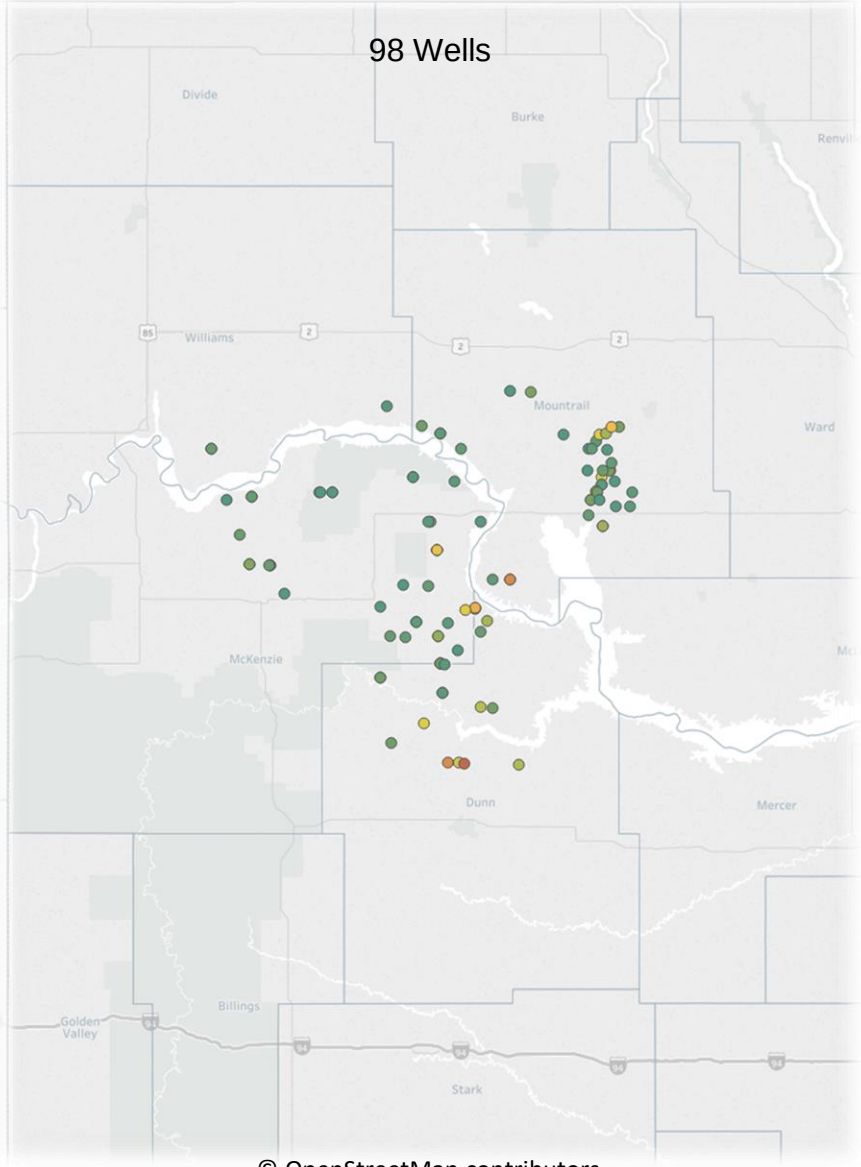
36 Wells



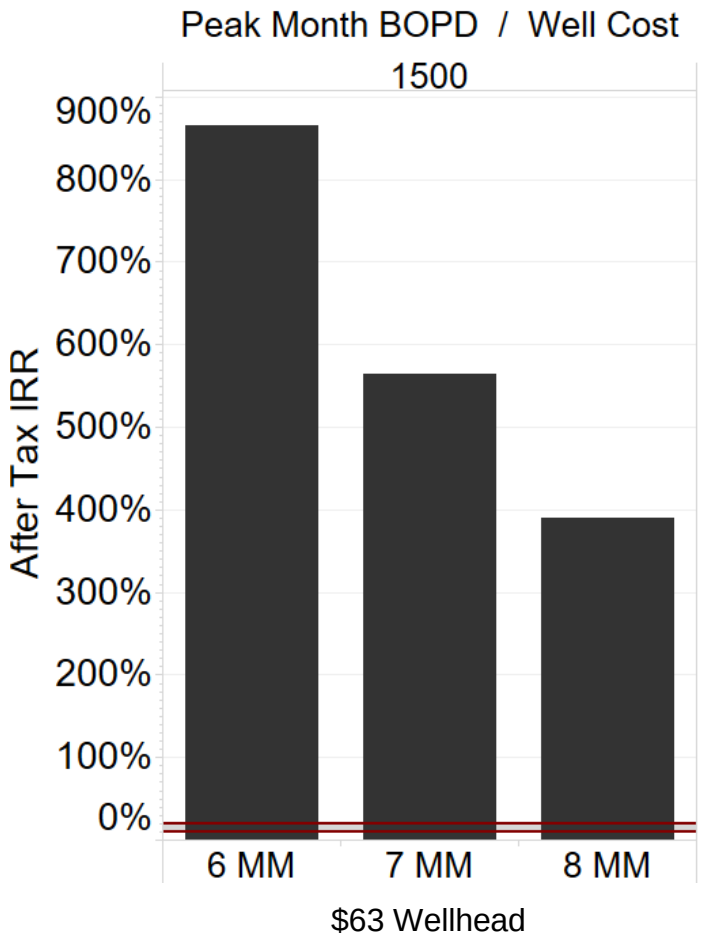
© OpenStreetMap contributors

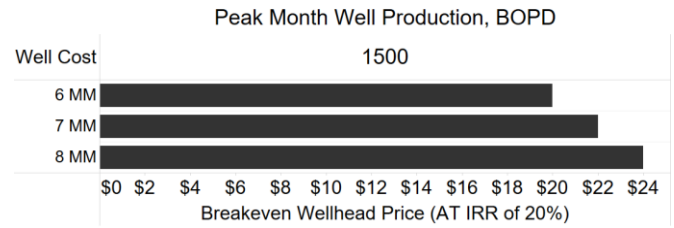
Bakken

98 Wells

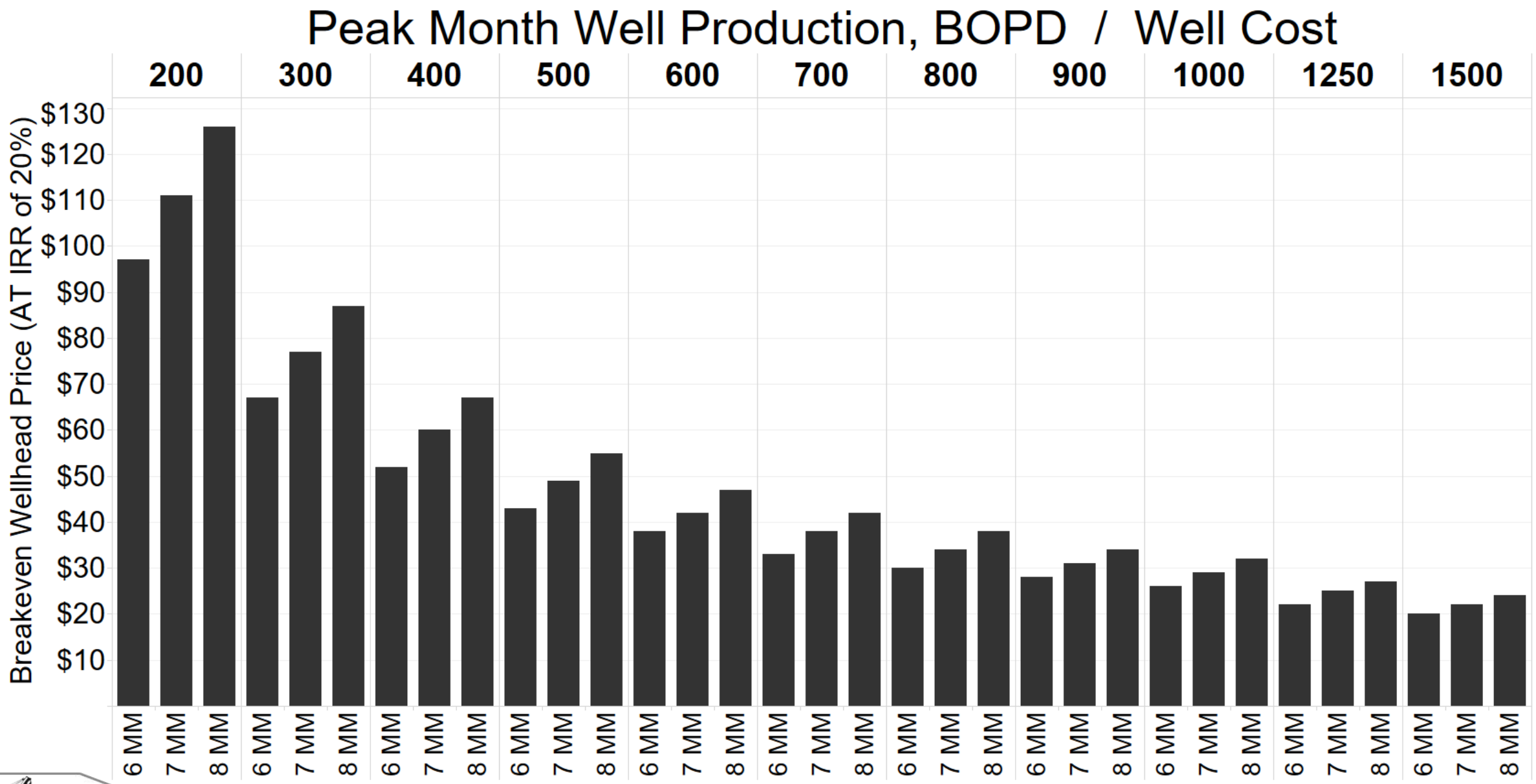


© OpenStreetMap contributors





Breakeven Summary



Understanding North Dakota's Bakken/Three Forks Potential*

**Version 1.1*

Updates & Modifications to Follow

Disclaimer

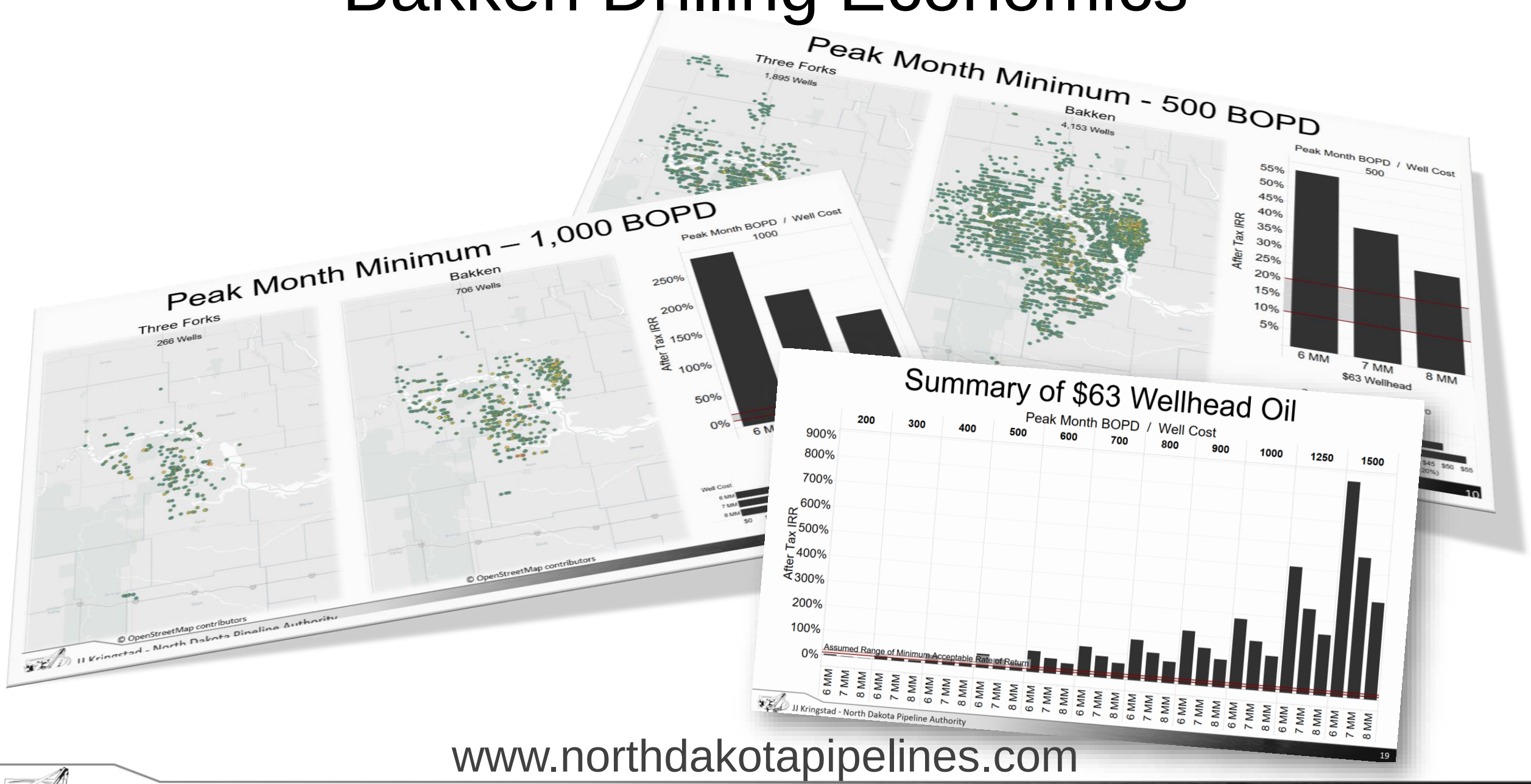
The goal of this work is not to imply individual company actions or intentions. All view expressed are strictly that of Justin J. Kringstad.

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 Assumptions & Considerations

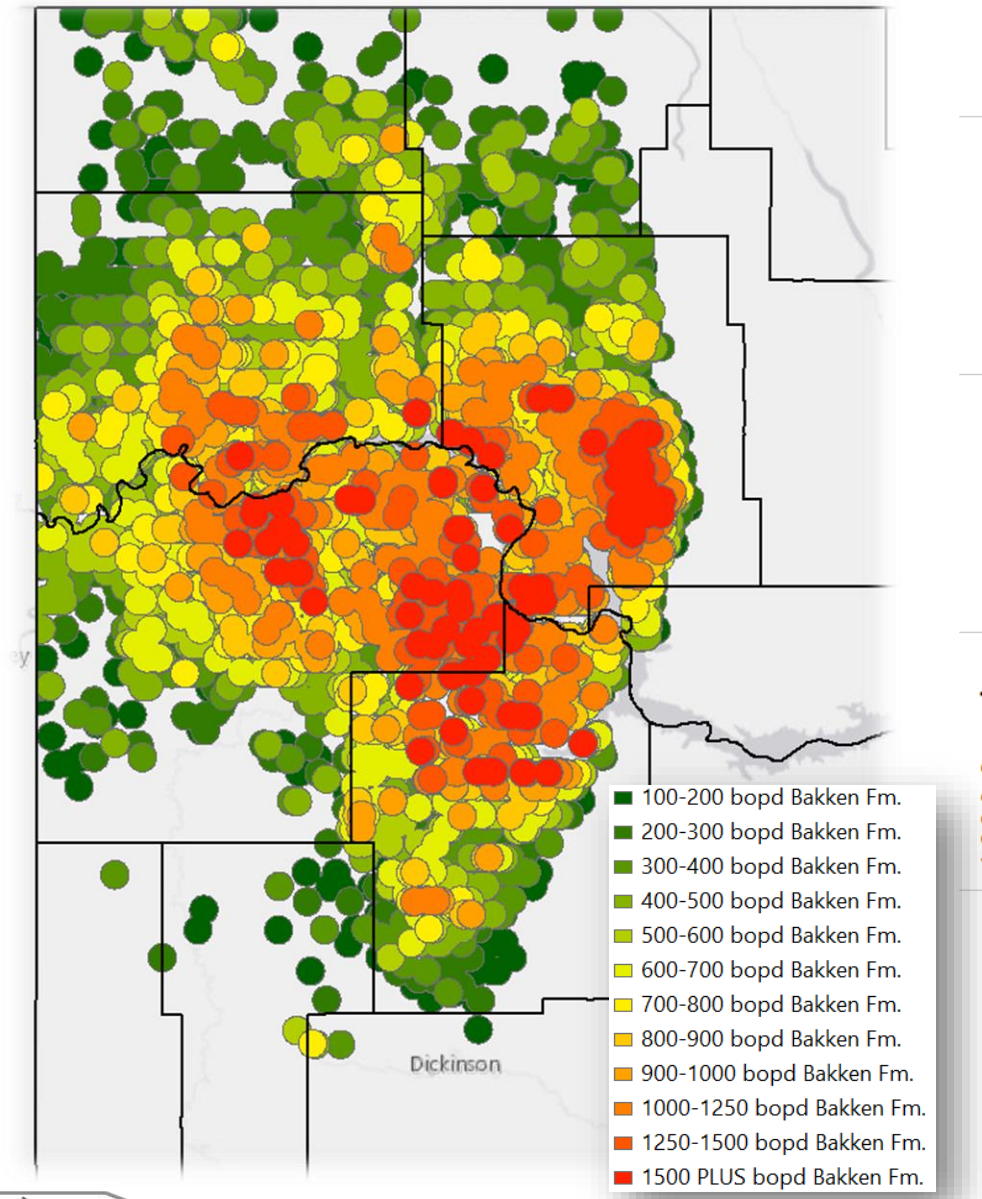
- Two mile production zone buffers are set by an individual well's "peak month minimum" performance. Not all existing wells within a production zone have performed at the zone's "peak month minimum" for a variety of reasons.
- High degree of uncertainty surrounding the future development patterns of the middle and lower Three Forks "Benches".
- High degree of economic uncertainty as infill development intensifies and deeper Three Forks benches are developed.
- This work will be updated as new information becomes available.

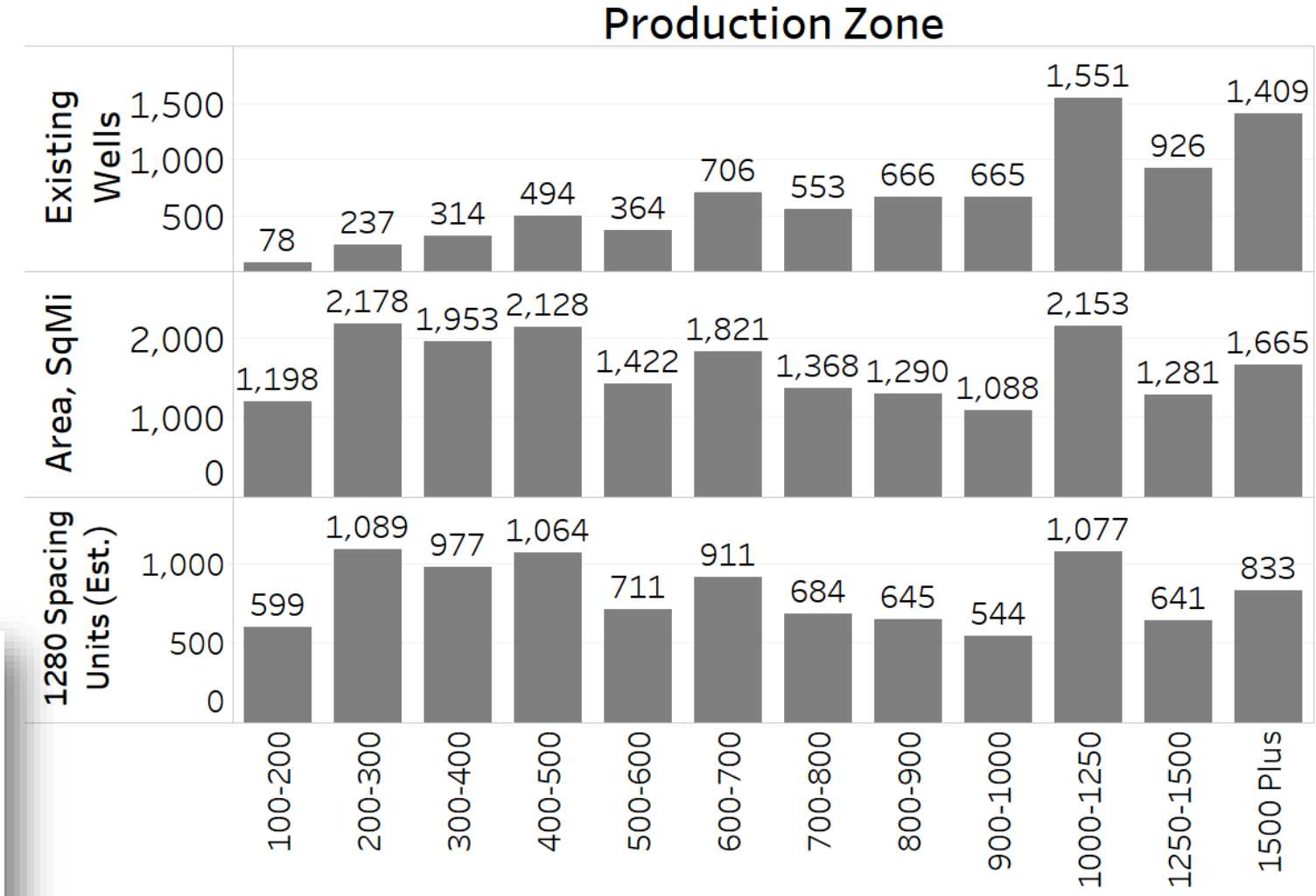
Bakken Drilling Economics



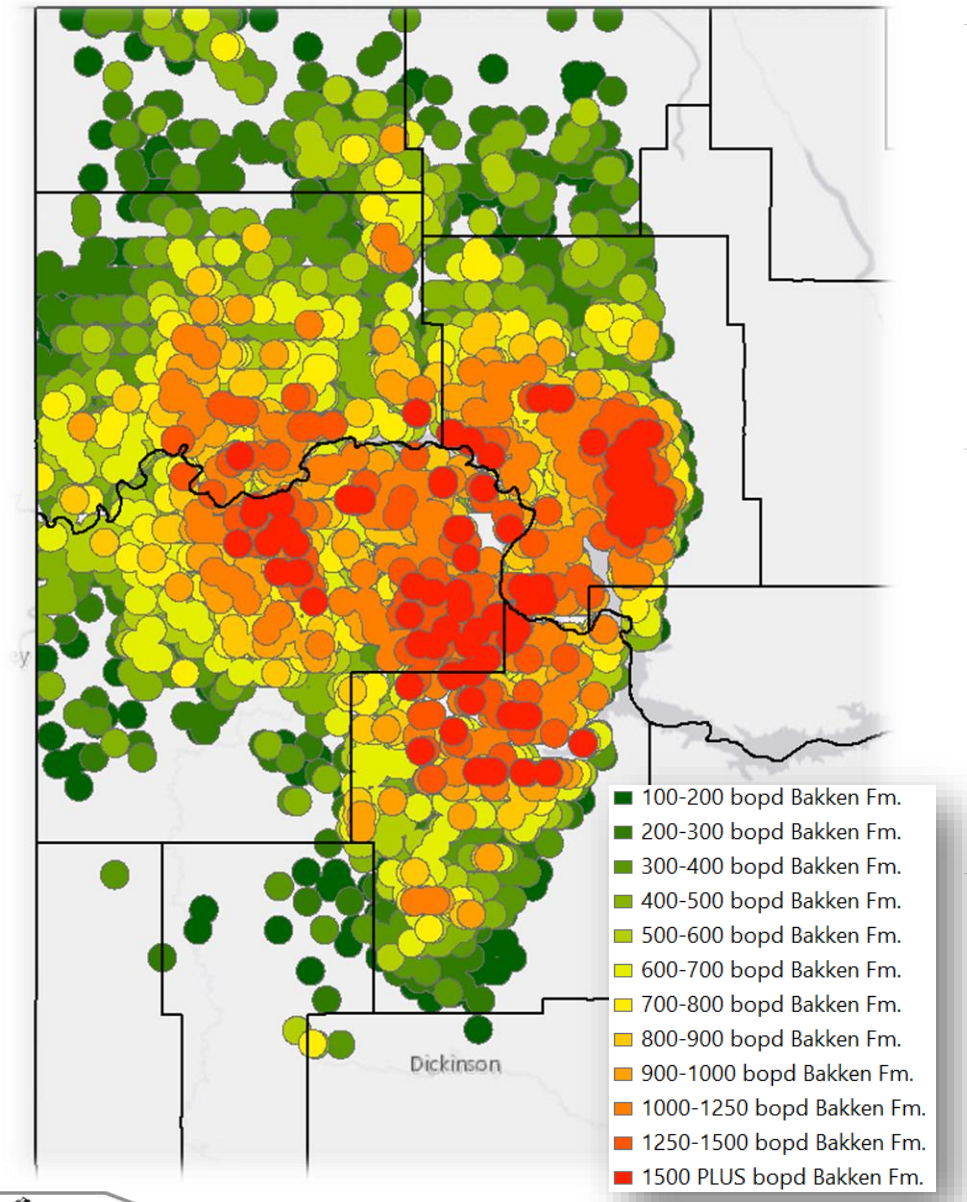
www.northdakotapipelines.com

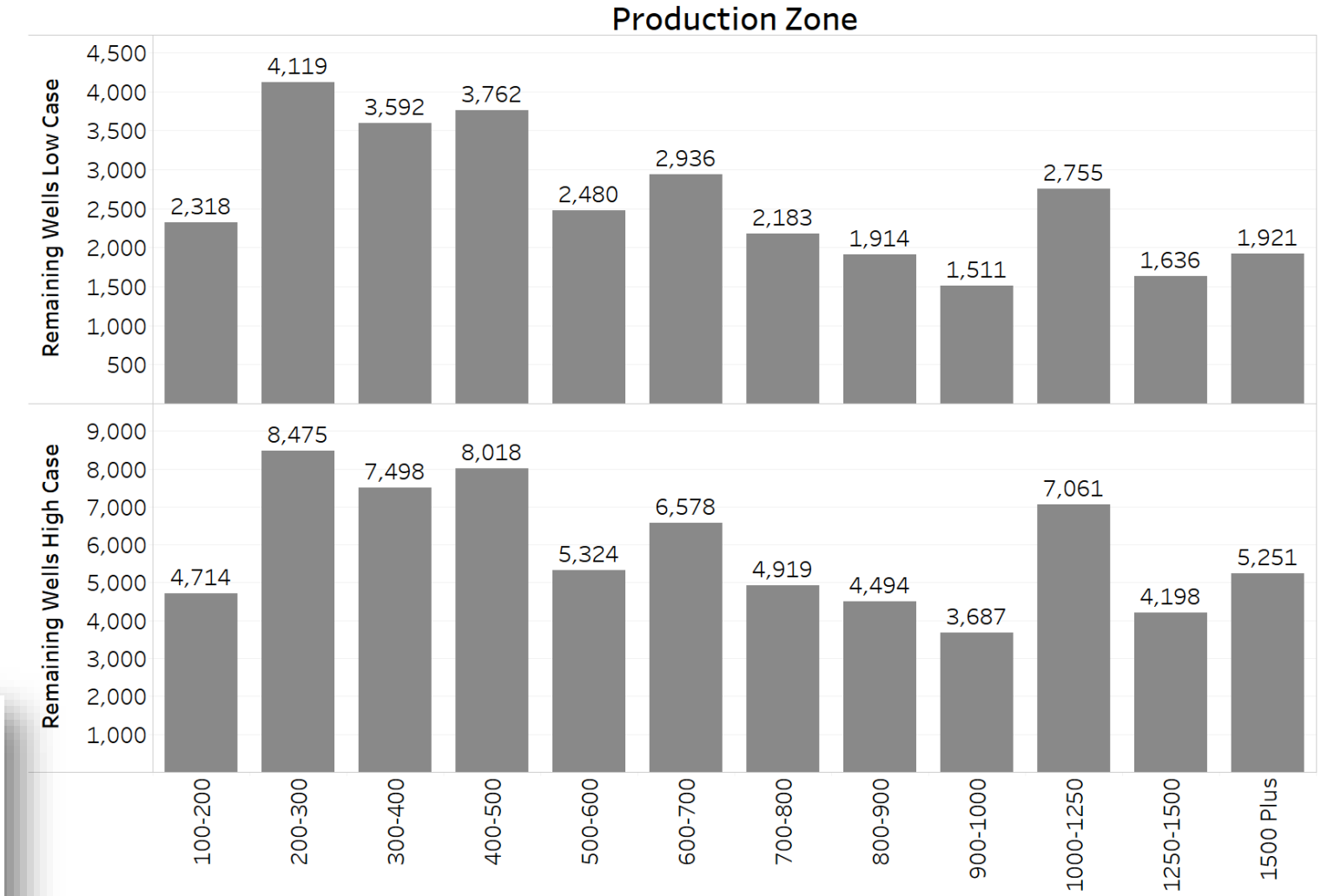
Past Well Performance – Bakken Formation





Remaining Wells* – Bakken Formation



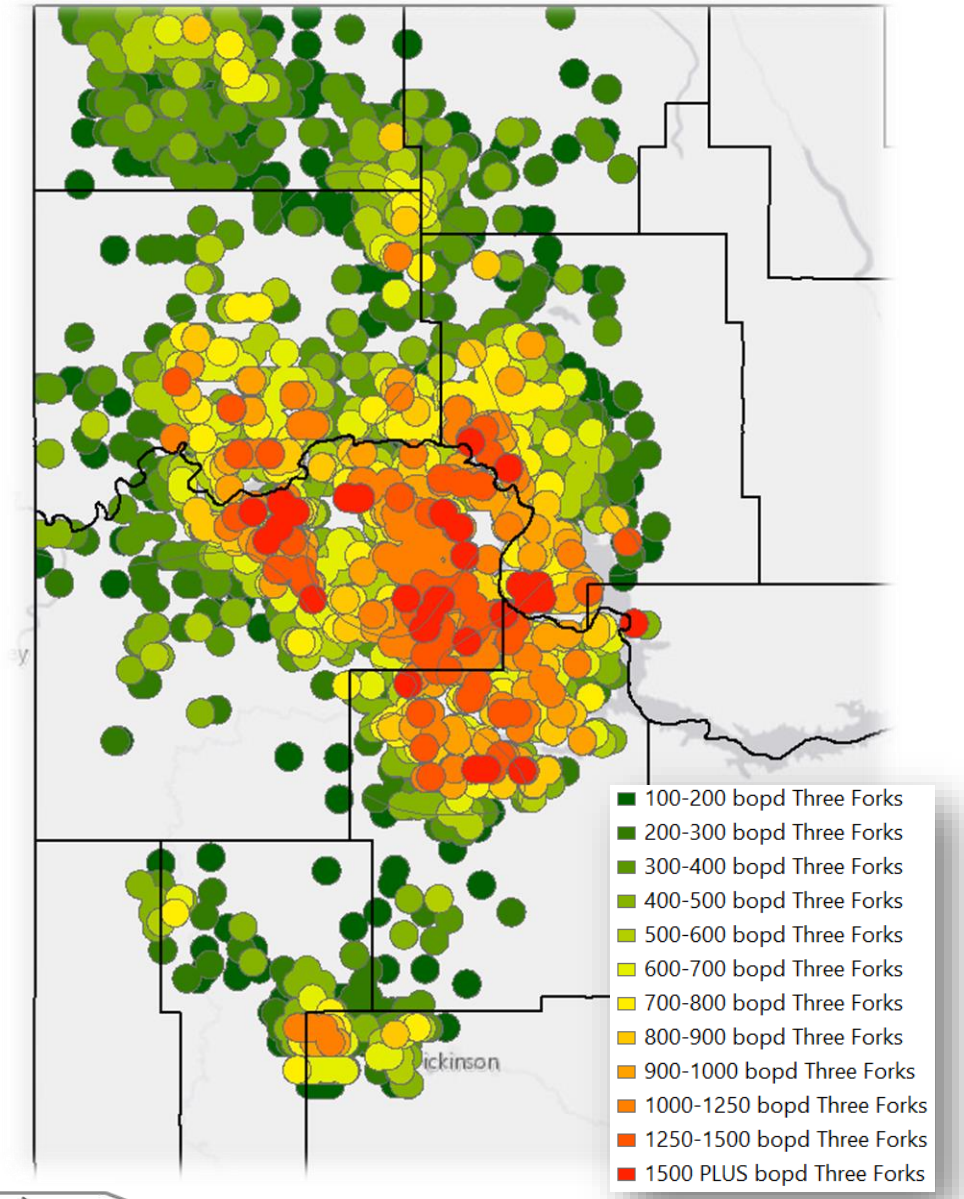


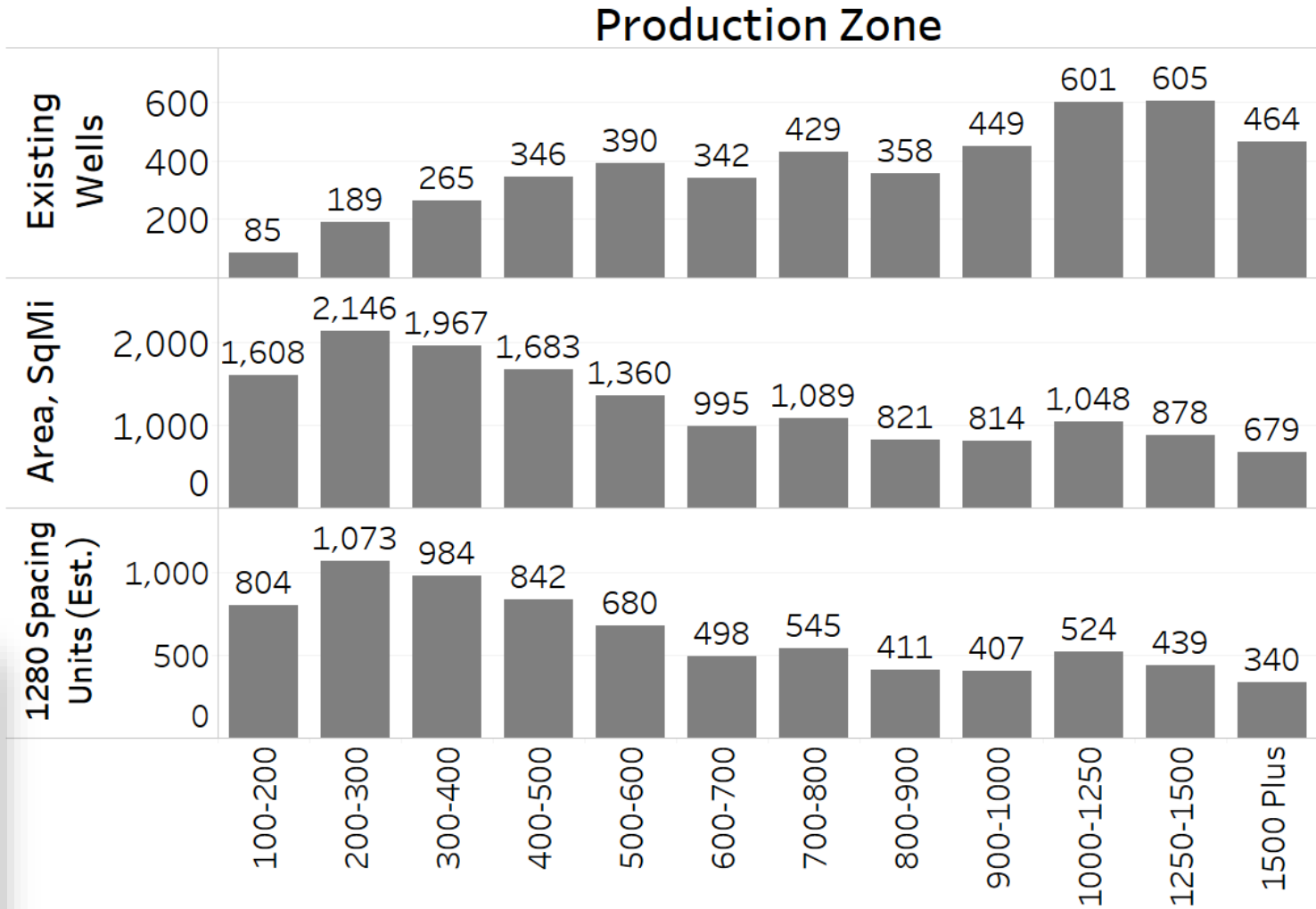
***Well Density Assumptions**

Low Case = 4 Wells In Bakken Formation

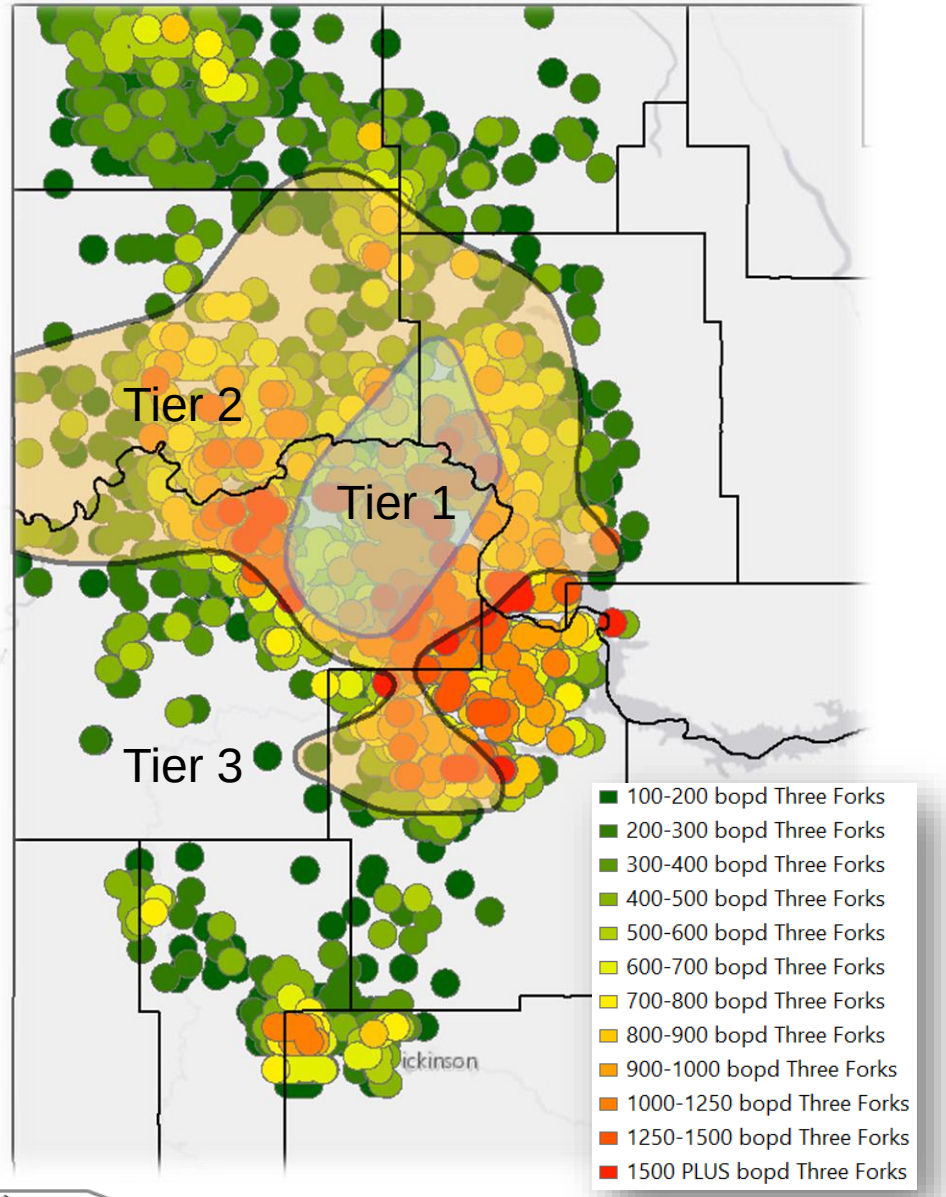
High Case = 8 Wells In Bakken Formation

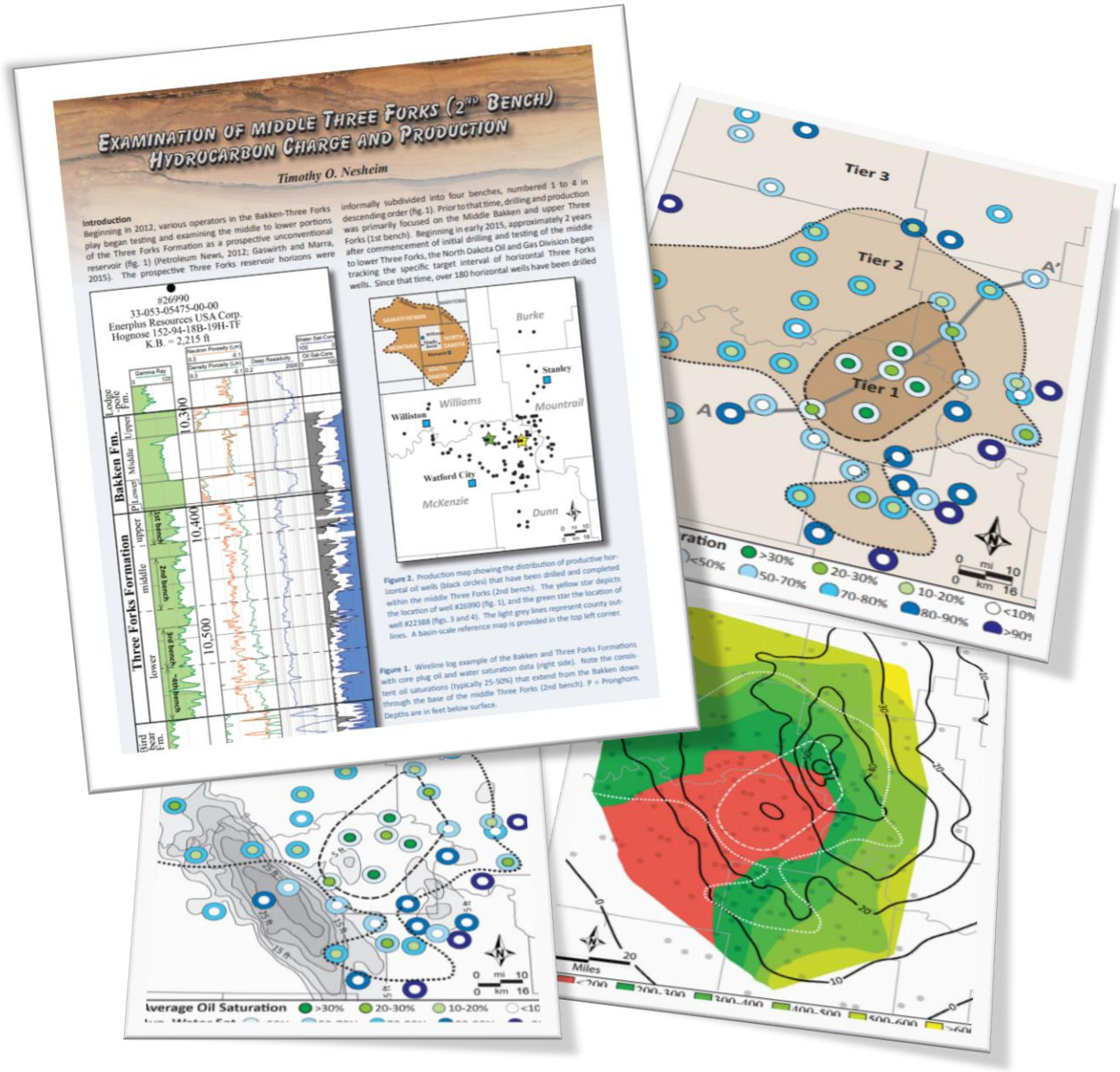
Past Well Performance – Three Forks Formation



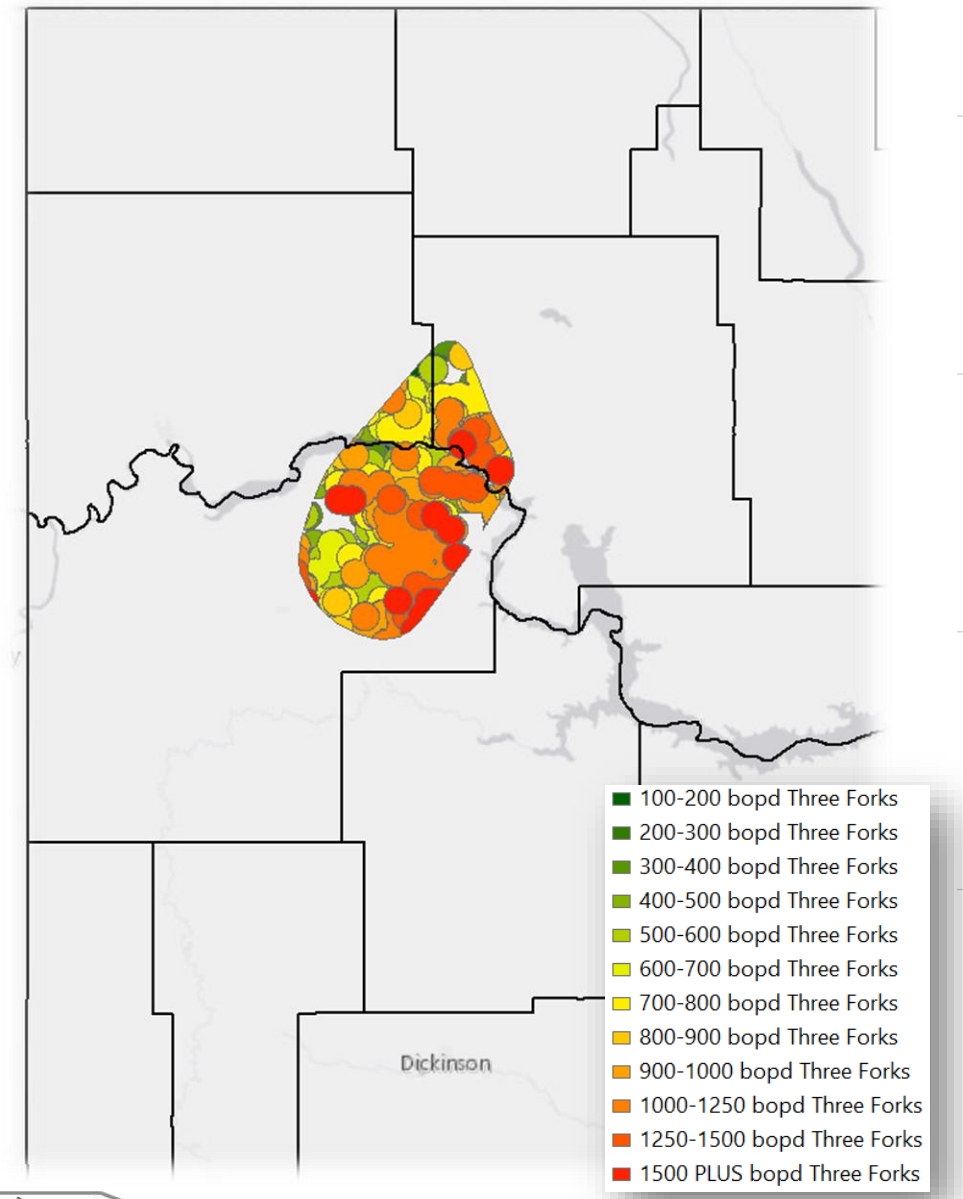


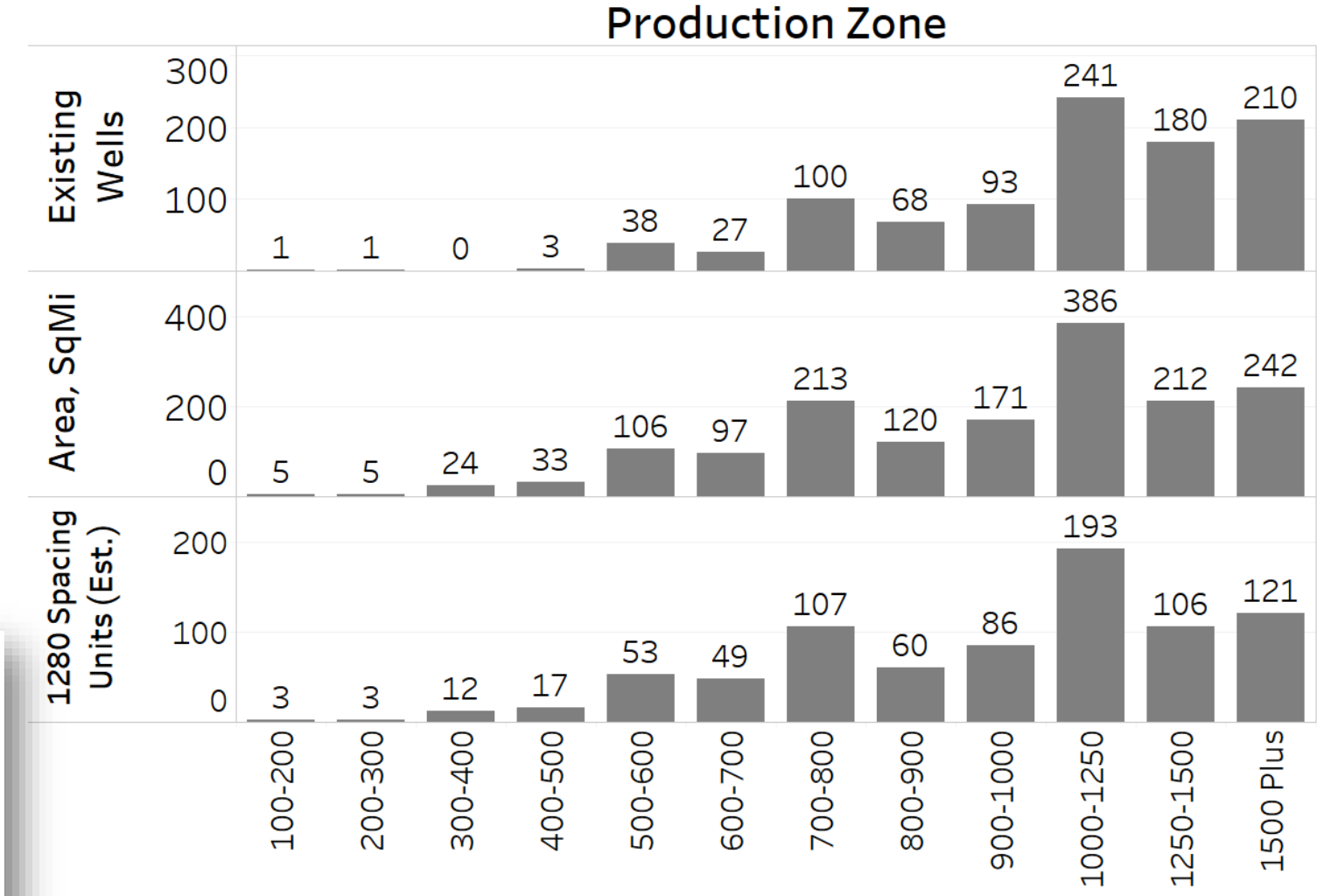
Tim Nesheim (NDGS) Three Forks Work



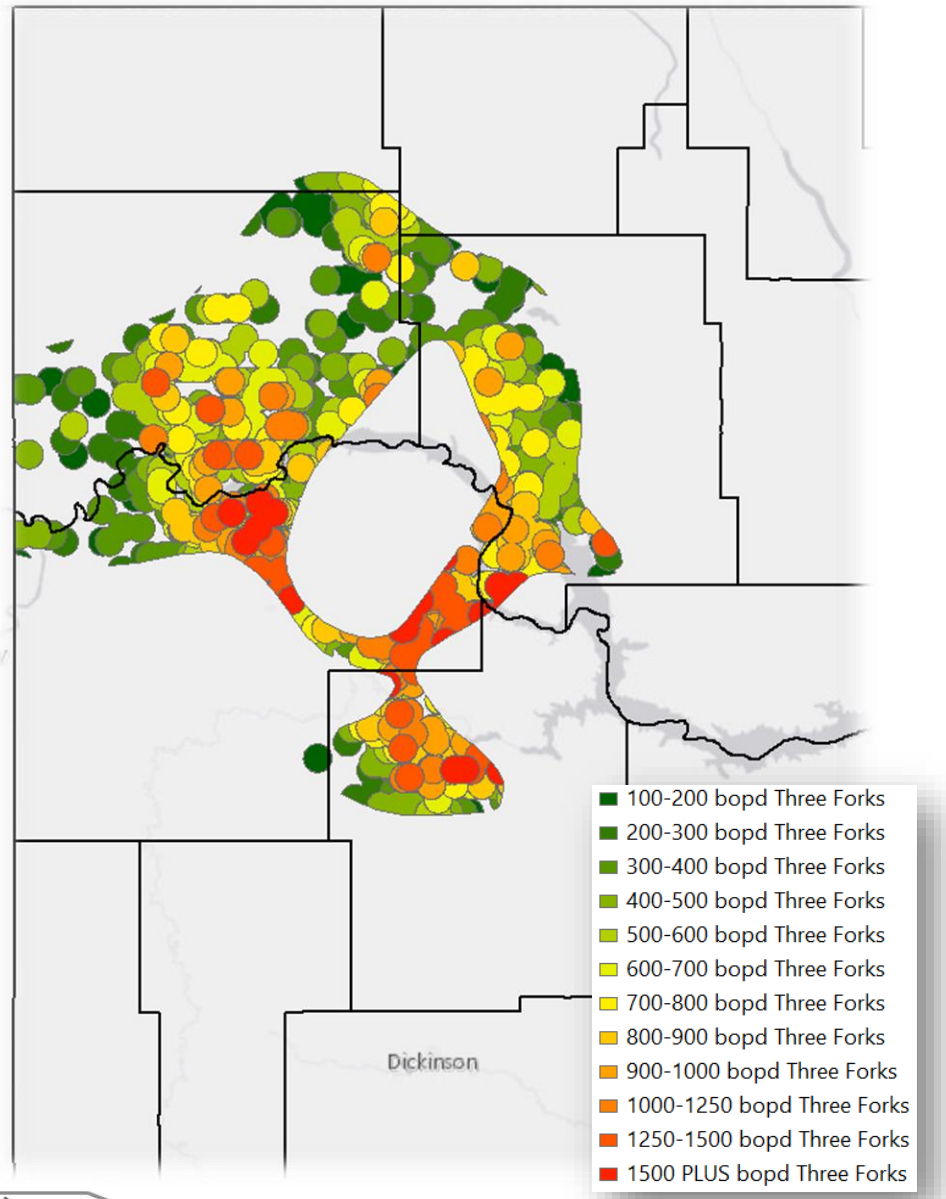


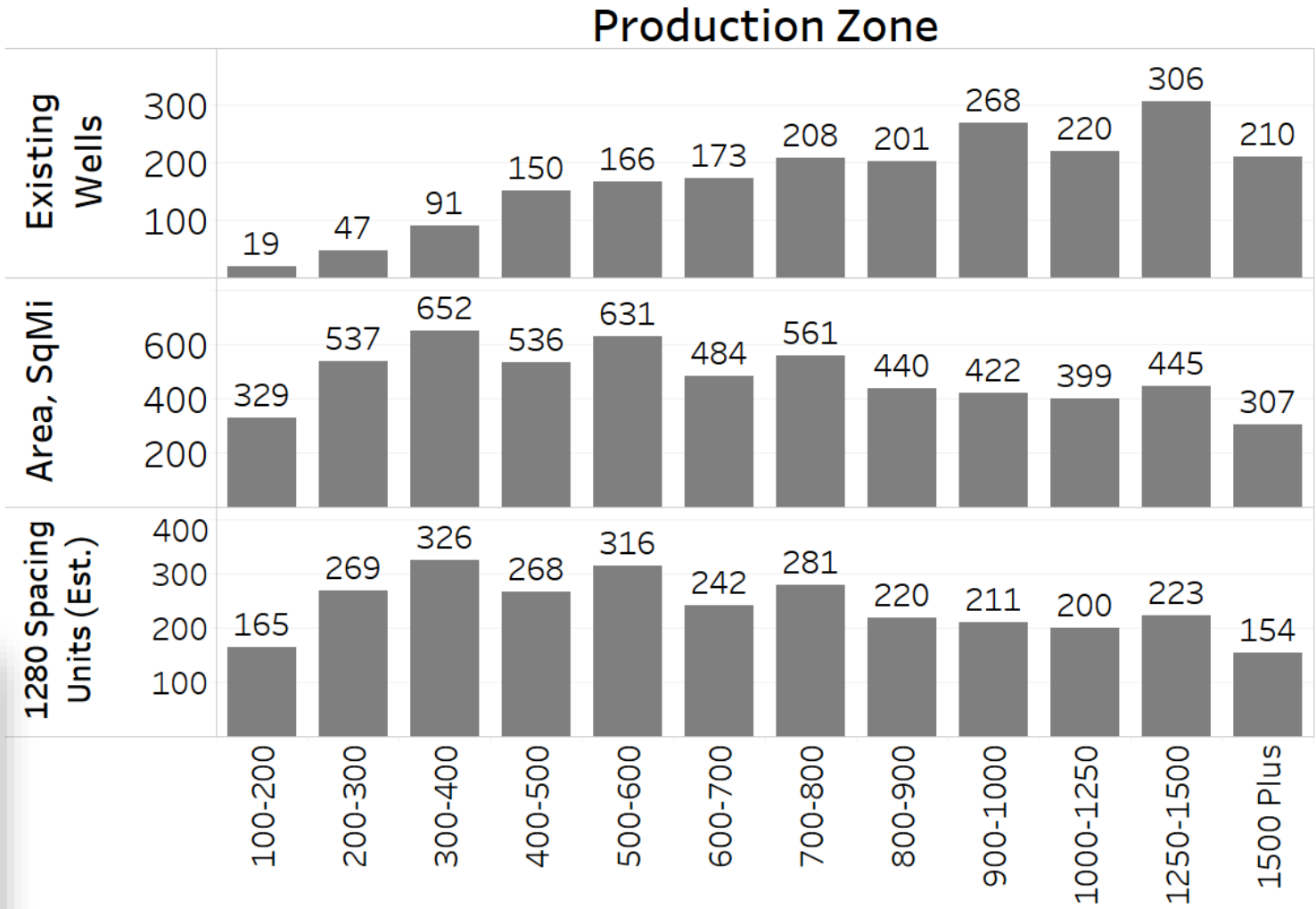
Past Well Performance – Three Forks Tier 1



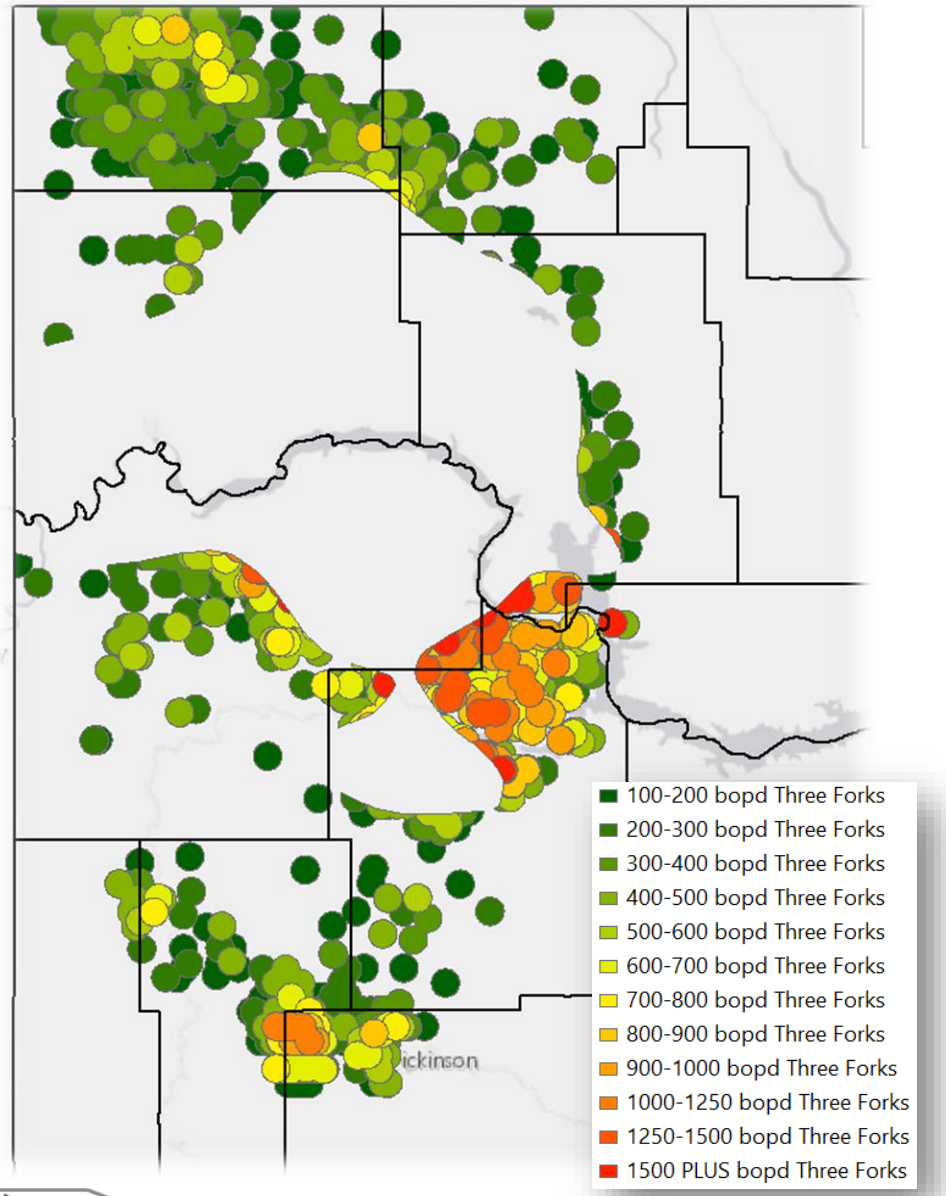


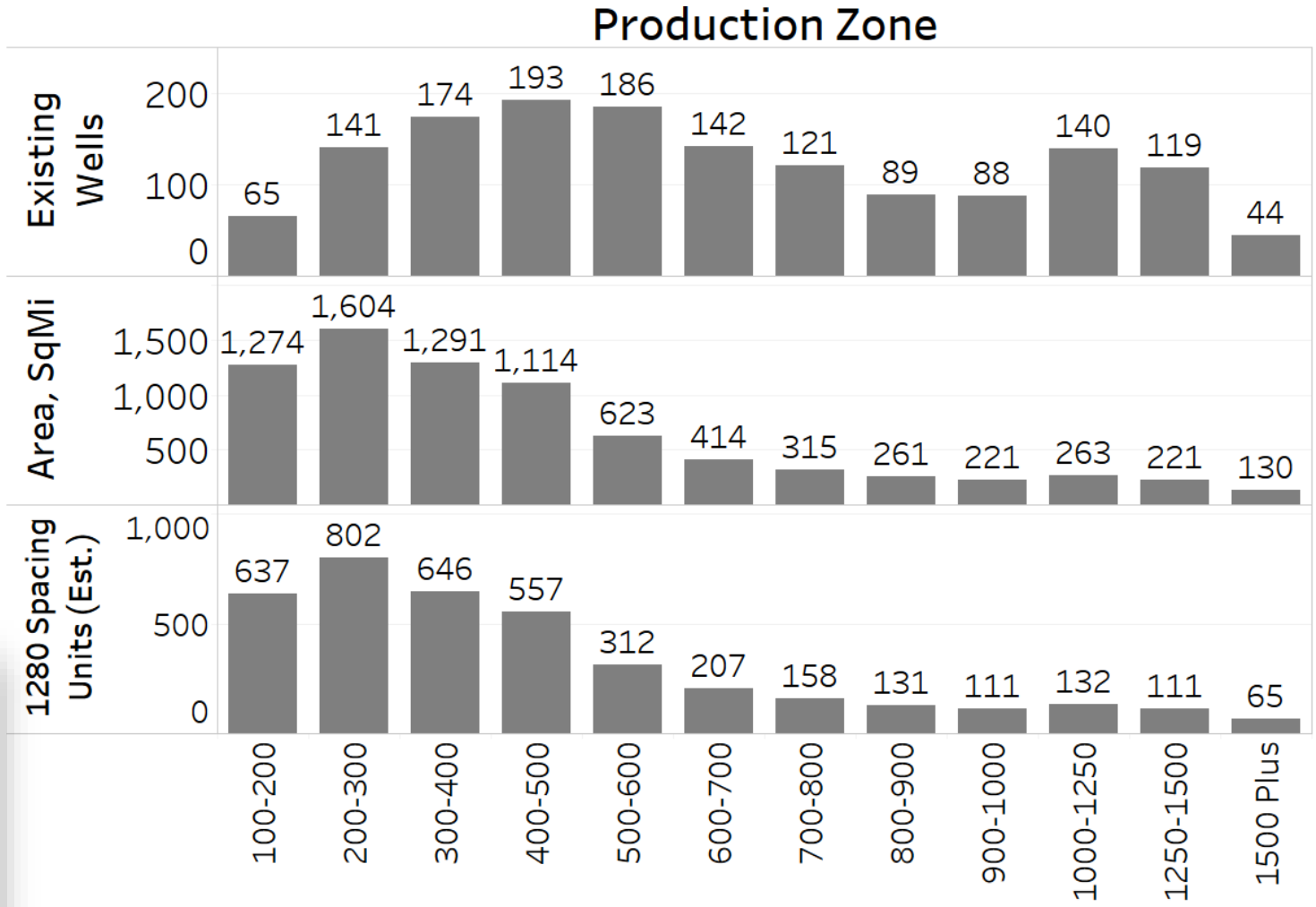
Past Well Performance – Three Forks Tier 2



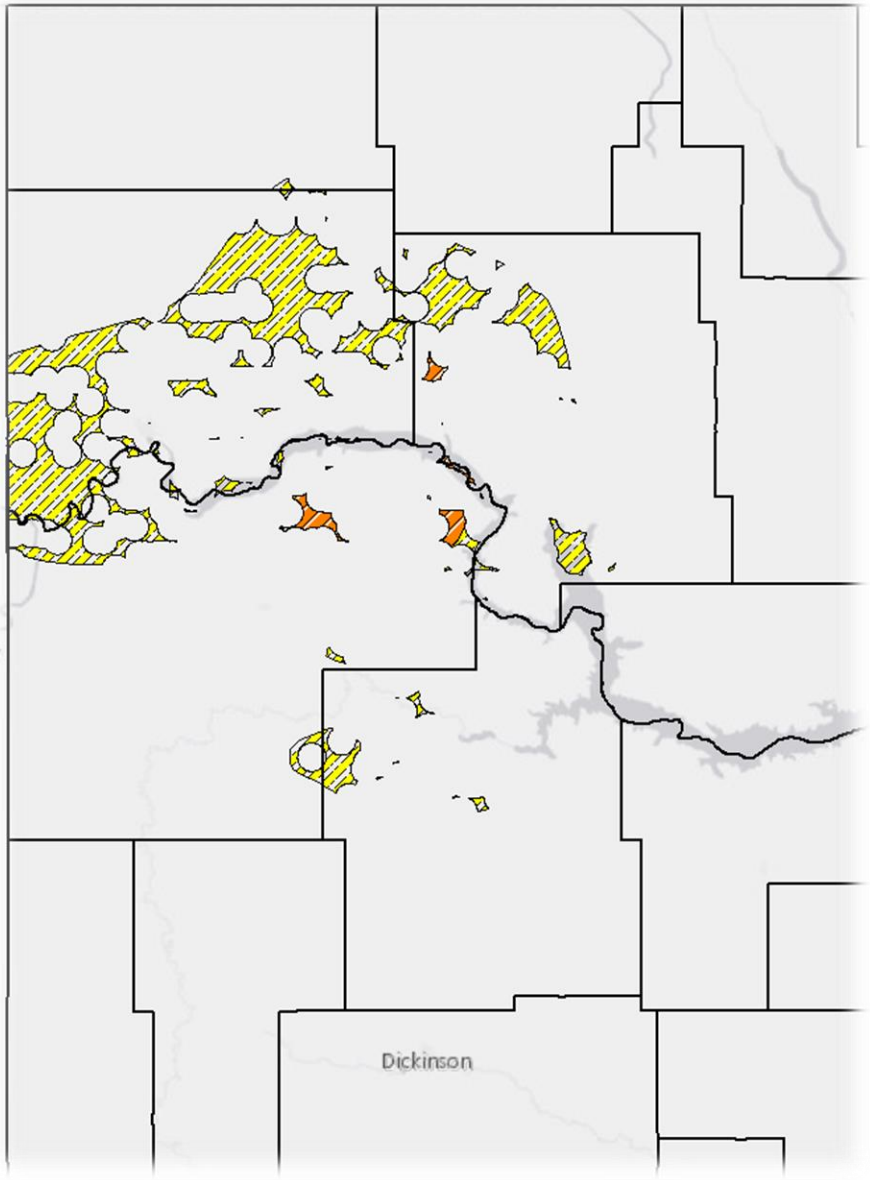


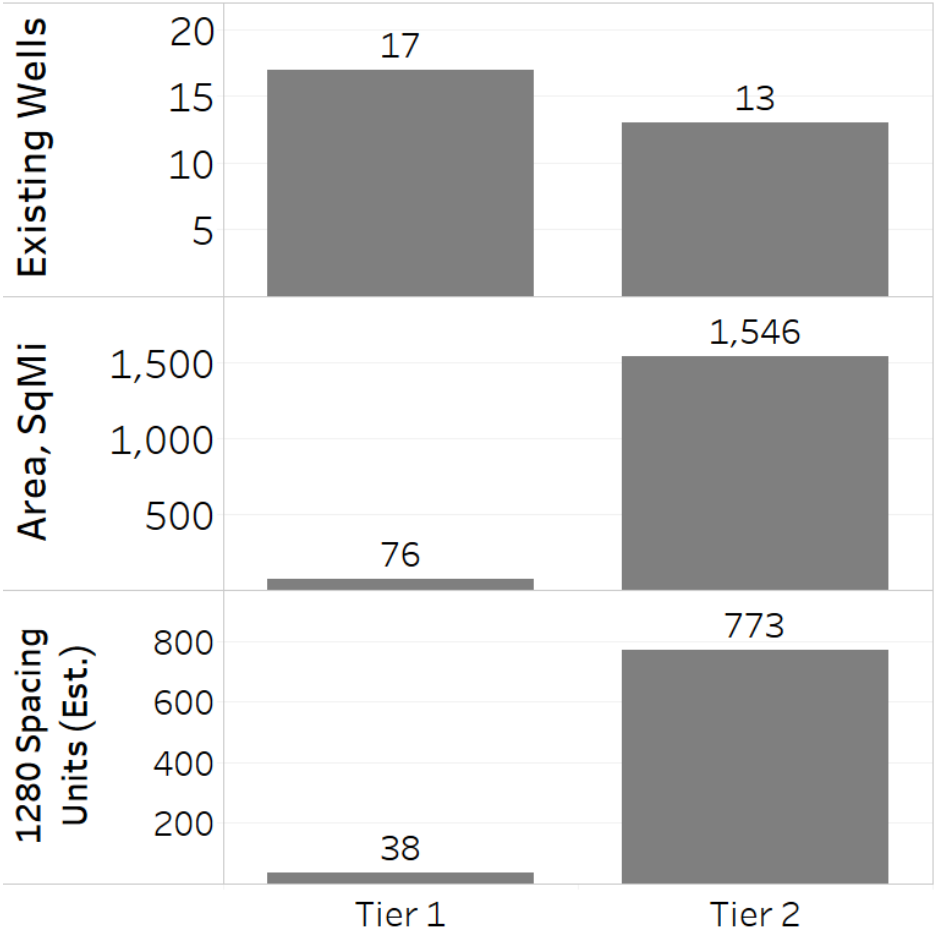
Past Well Performance – Three Forks Tier 3





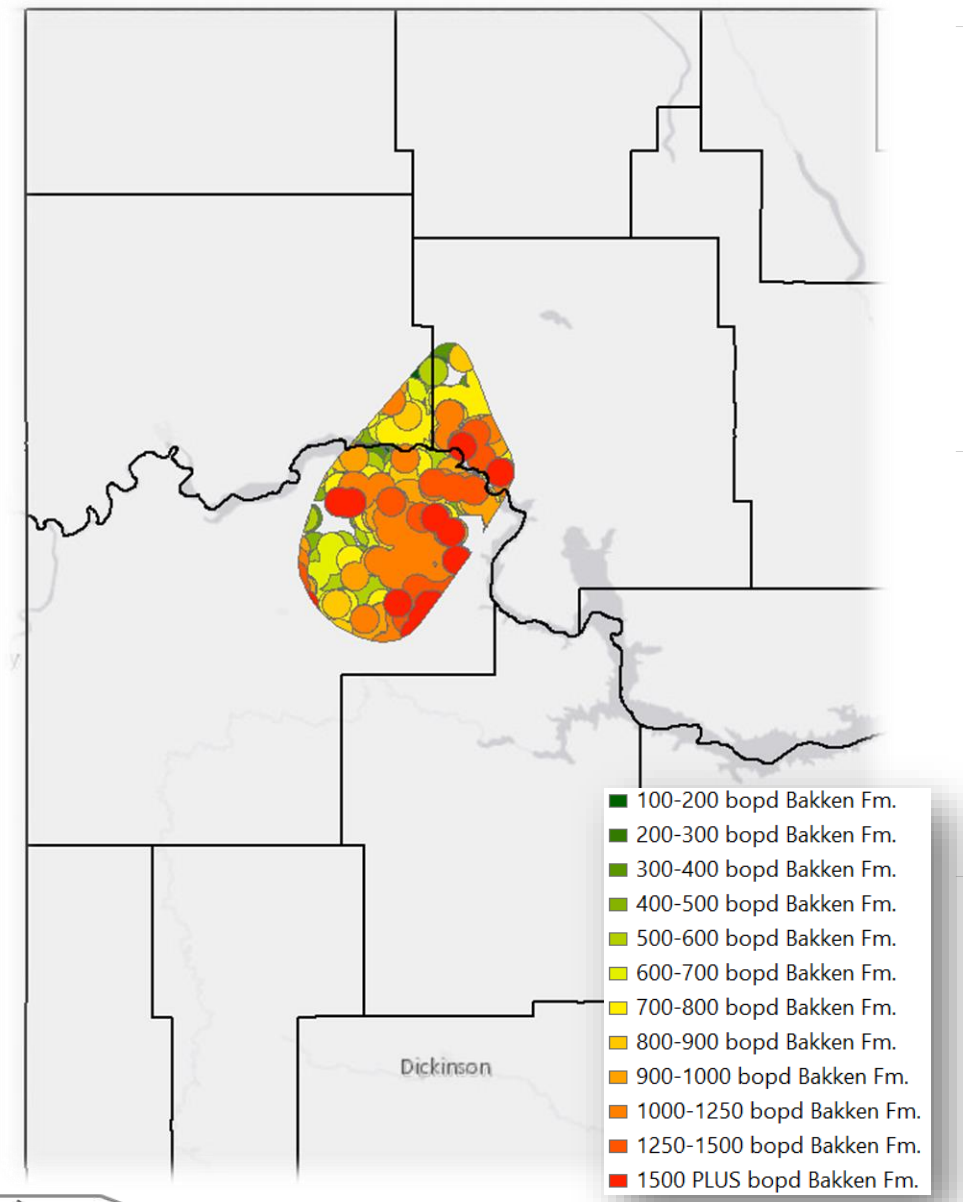
“Empty” Three Forks Tier 1 & 2

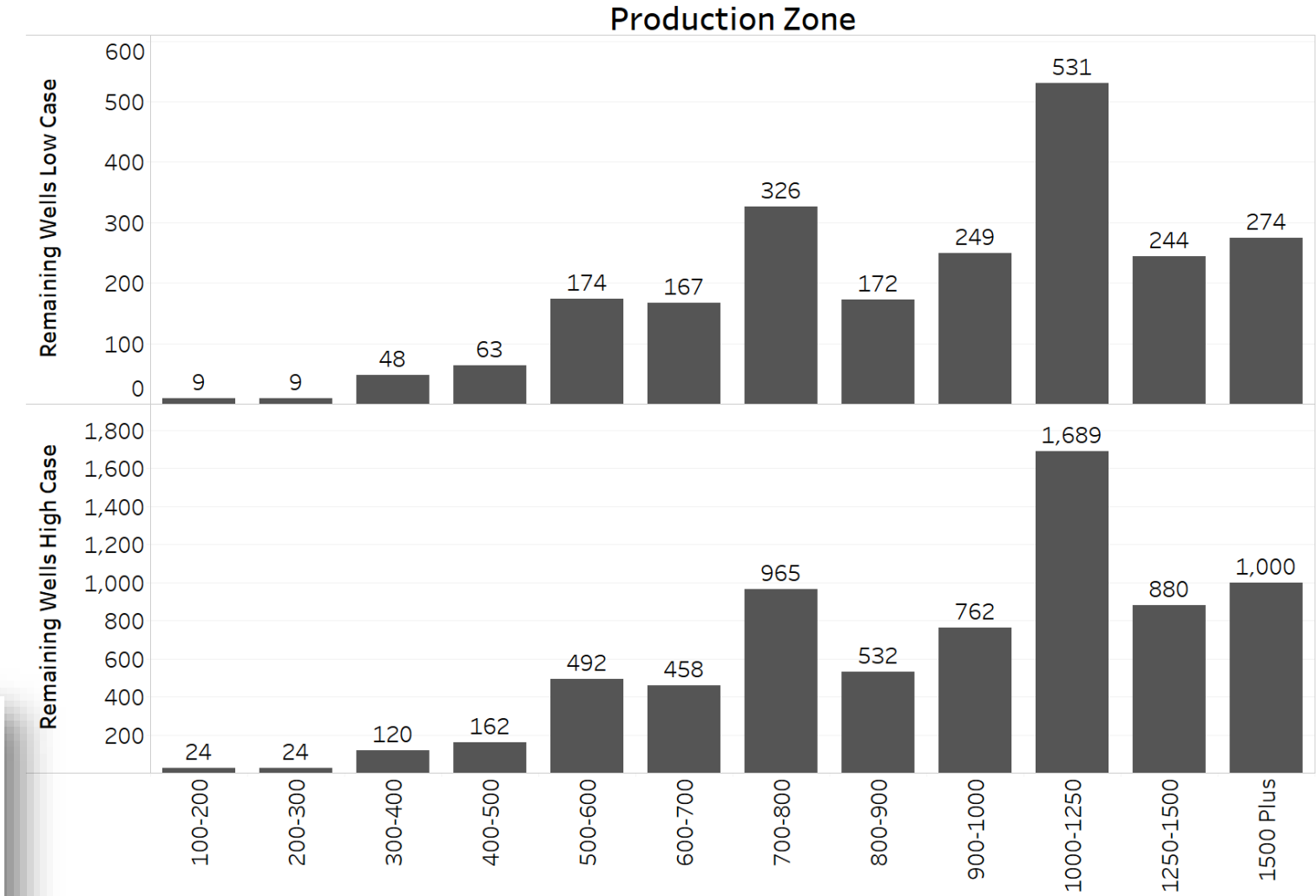




All Empty Regions Were Removed From Estimates/Calculations

Remaining Wells* – Three Forks Tier 1



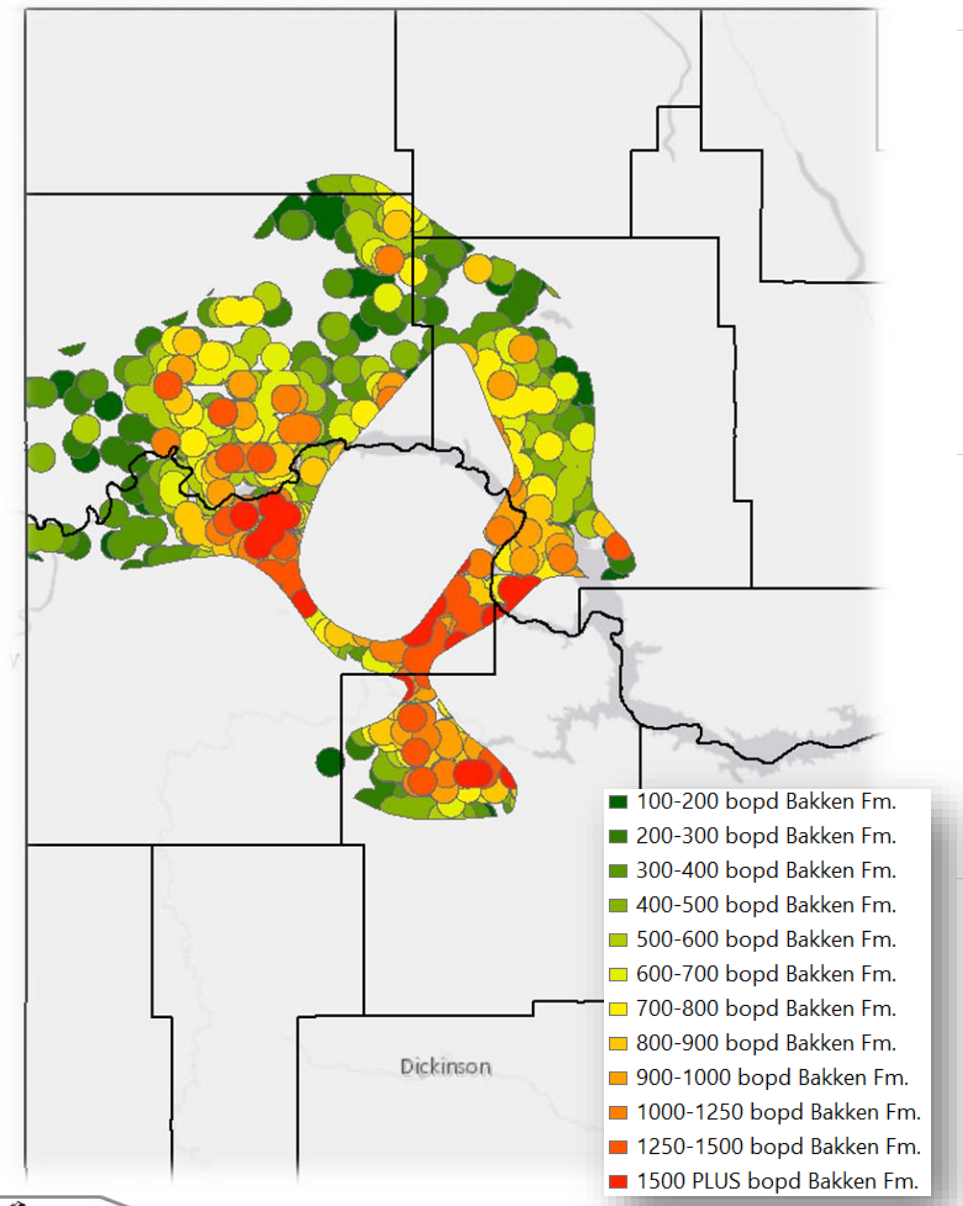


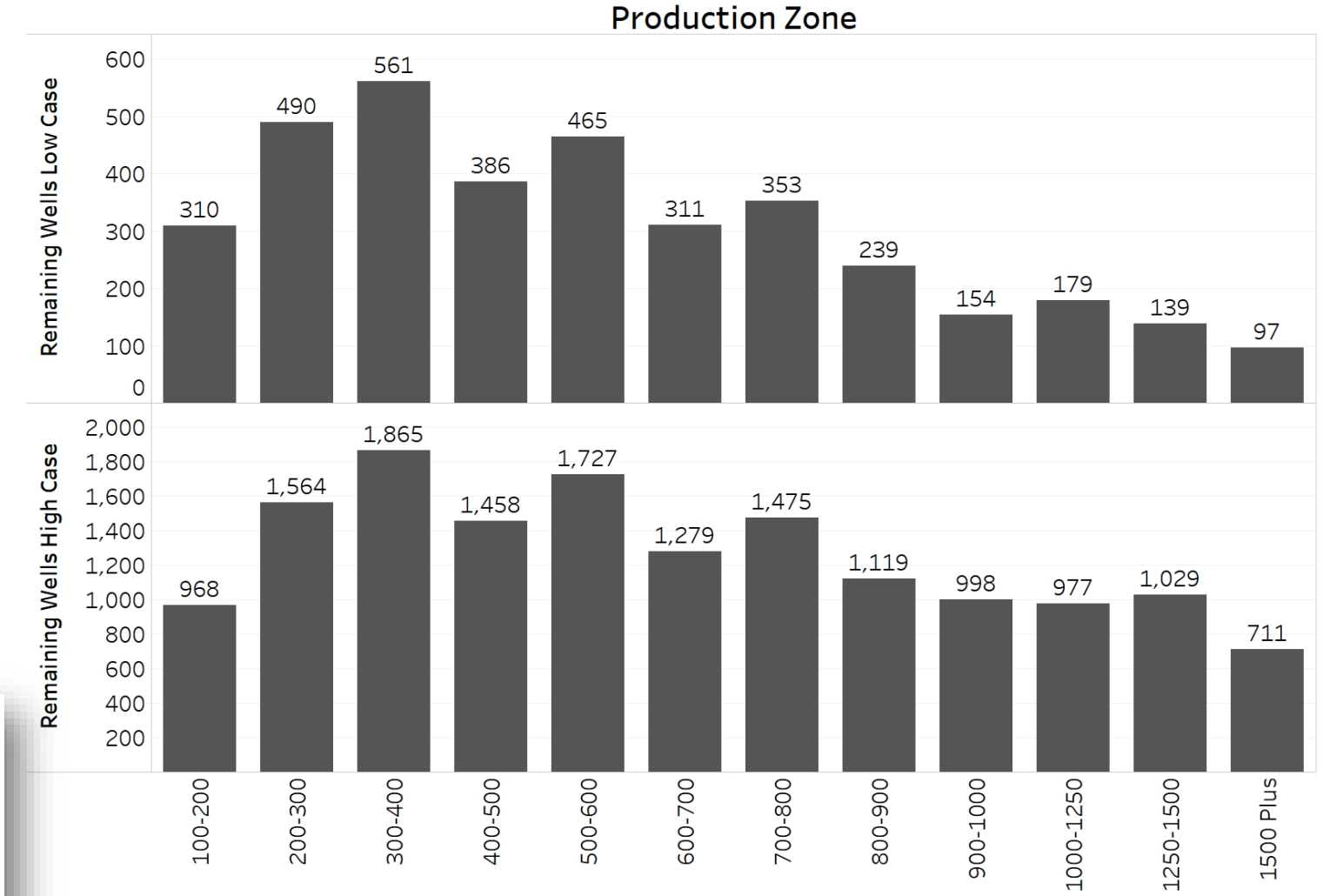
***Well Density Assumptions**

Low Case = 4 Three Forks Wells Per DSU

High Case = 10 Three Forks Wells Per DSU

Remaining Wells* – Three Forks Tier 2



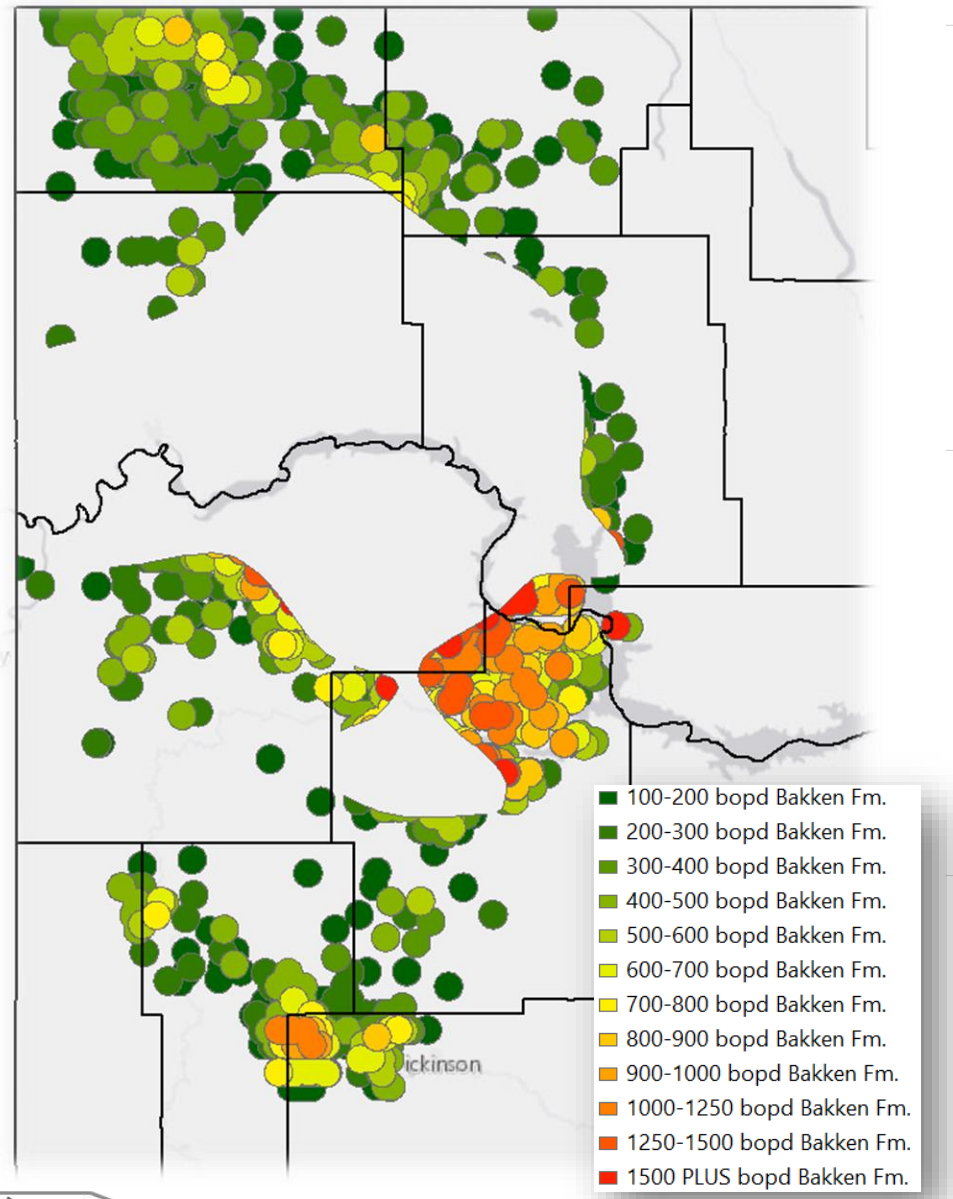


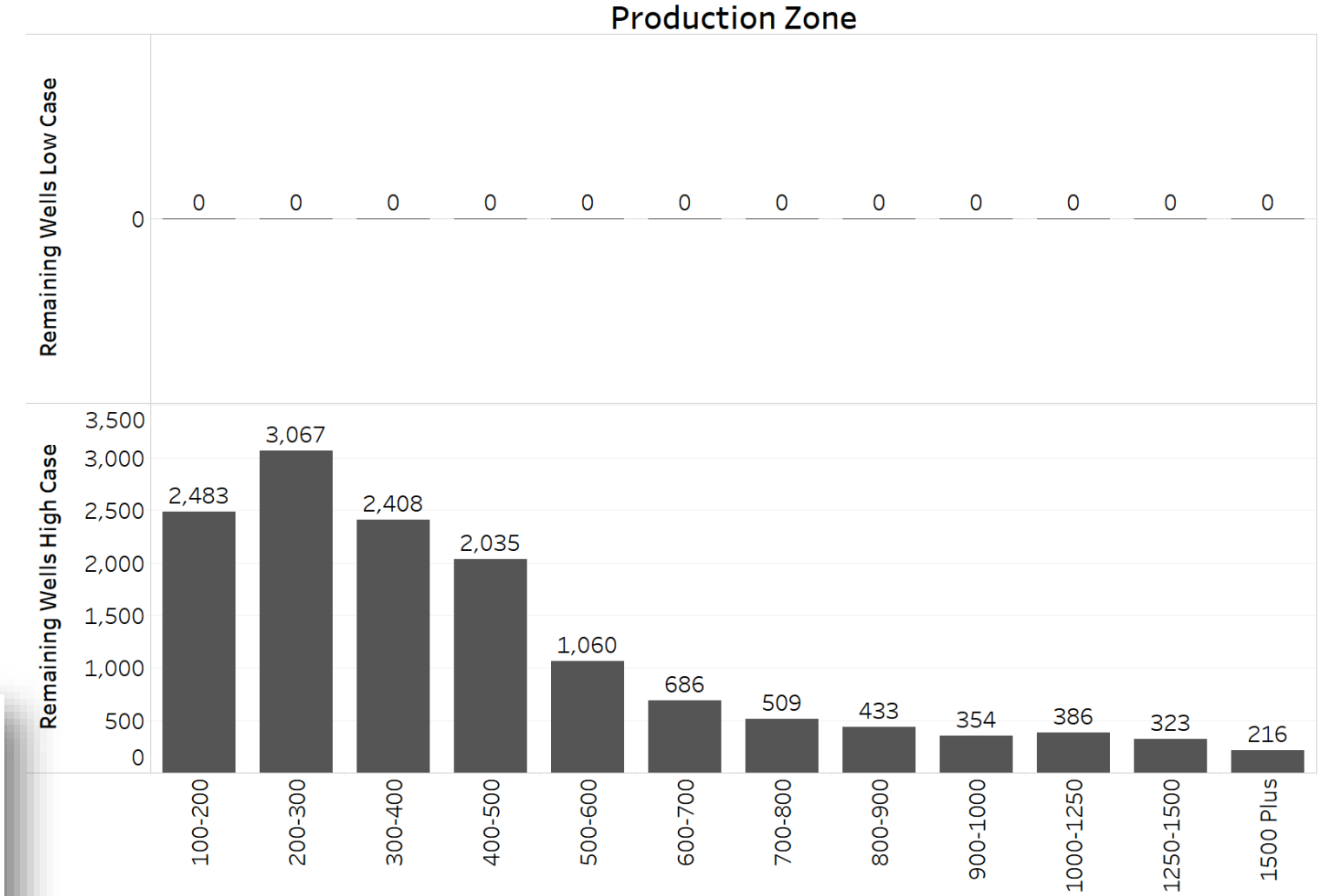
***Well Density Assumptions**

Low Case = 2 Three Forks Wells Per DSU

High Case = 6 Three Forks Wells Per DSU

Remaining Wells* – Three Forks Tier 3



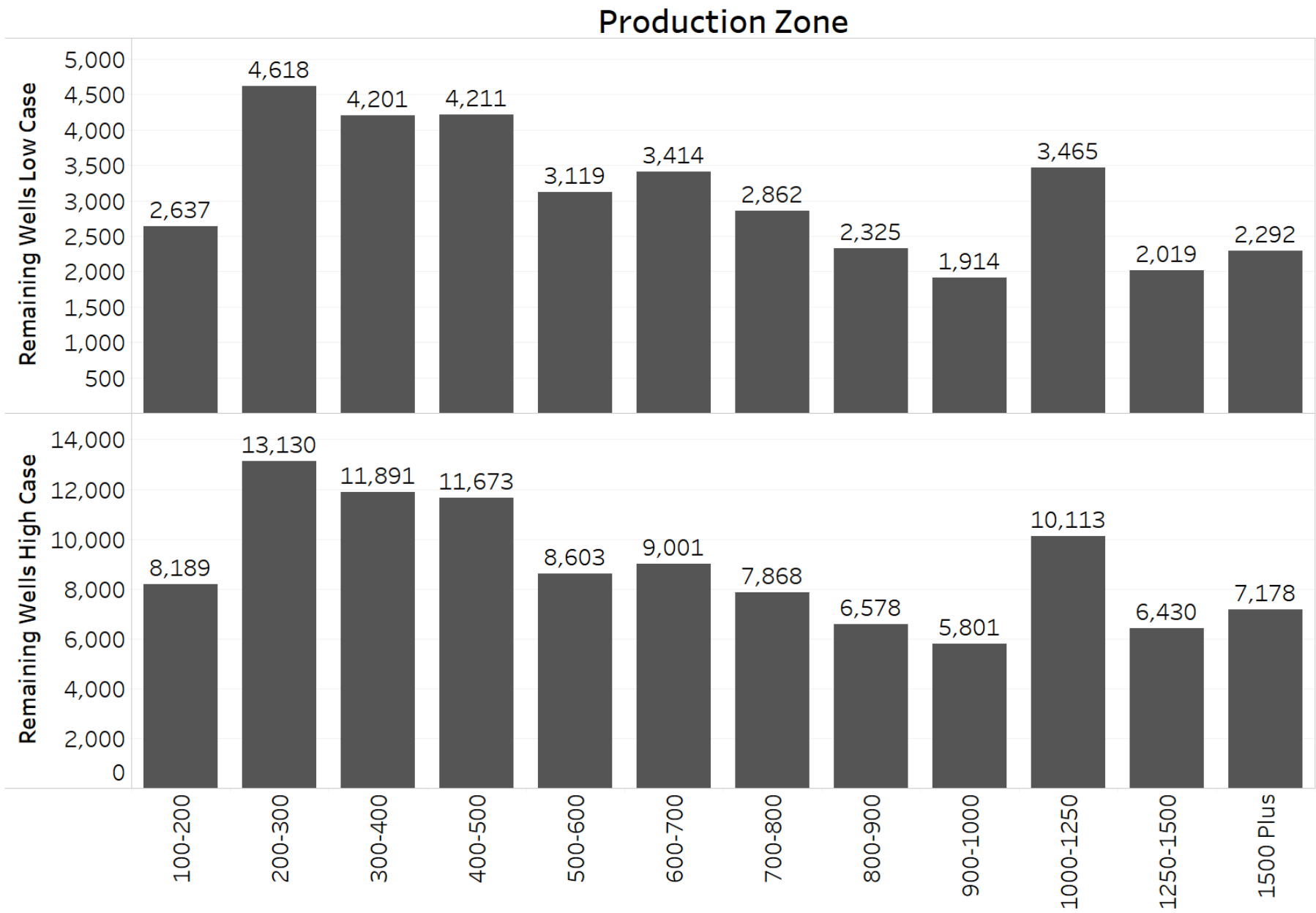


<u>*Well Density Assumptions</u>

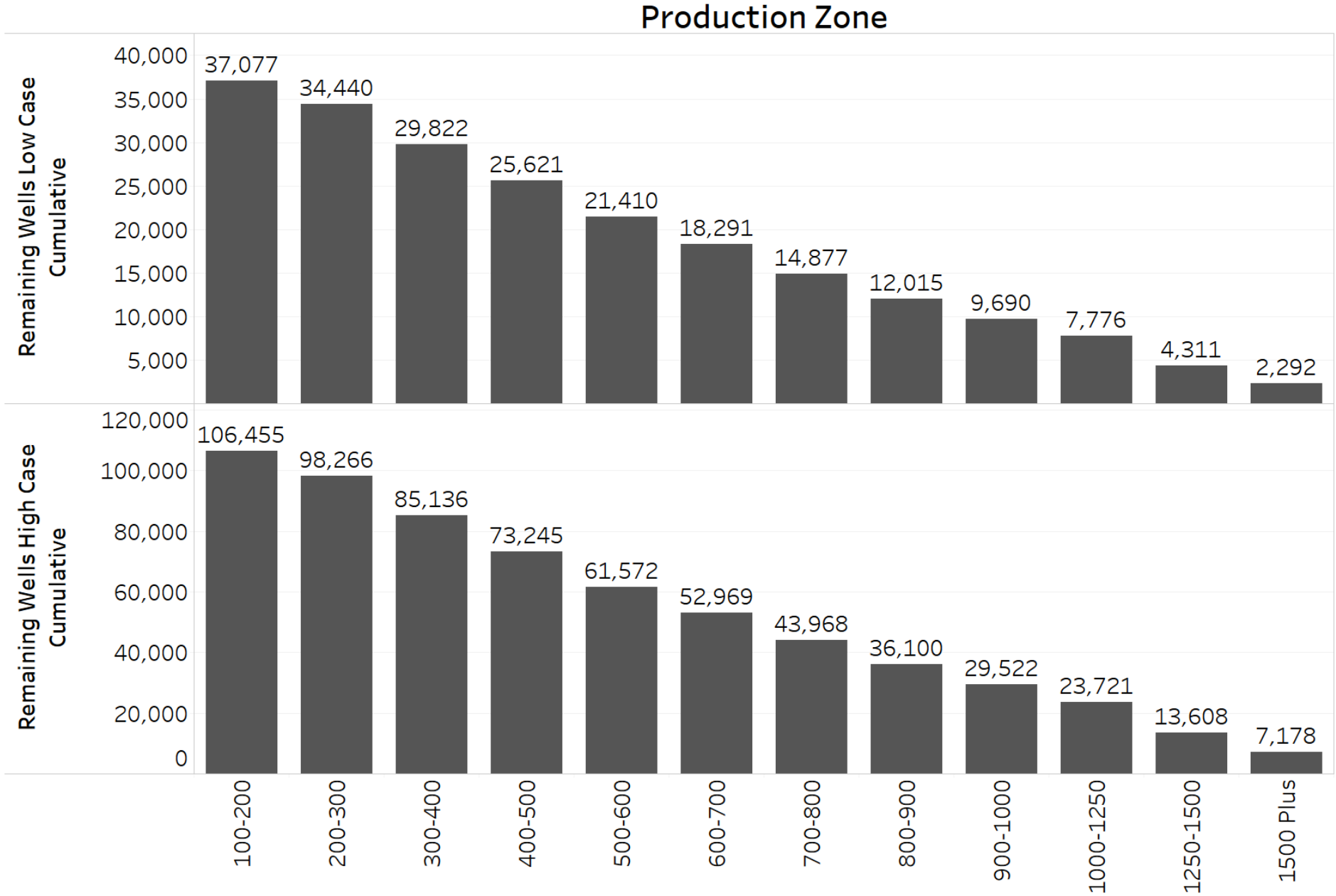
Low Case = 0 Three Forks Wells Per DSU

High Case = 4 Three Forks Wells Per DSU

Remaining Wells – All Bakken and Three Forks Tiers

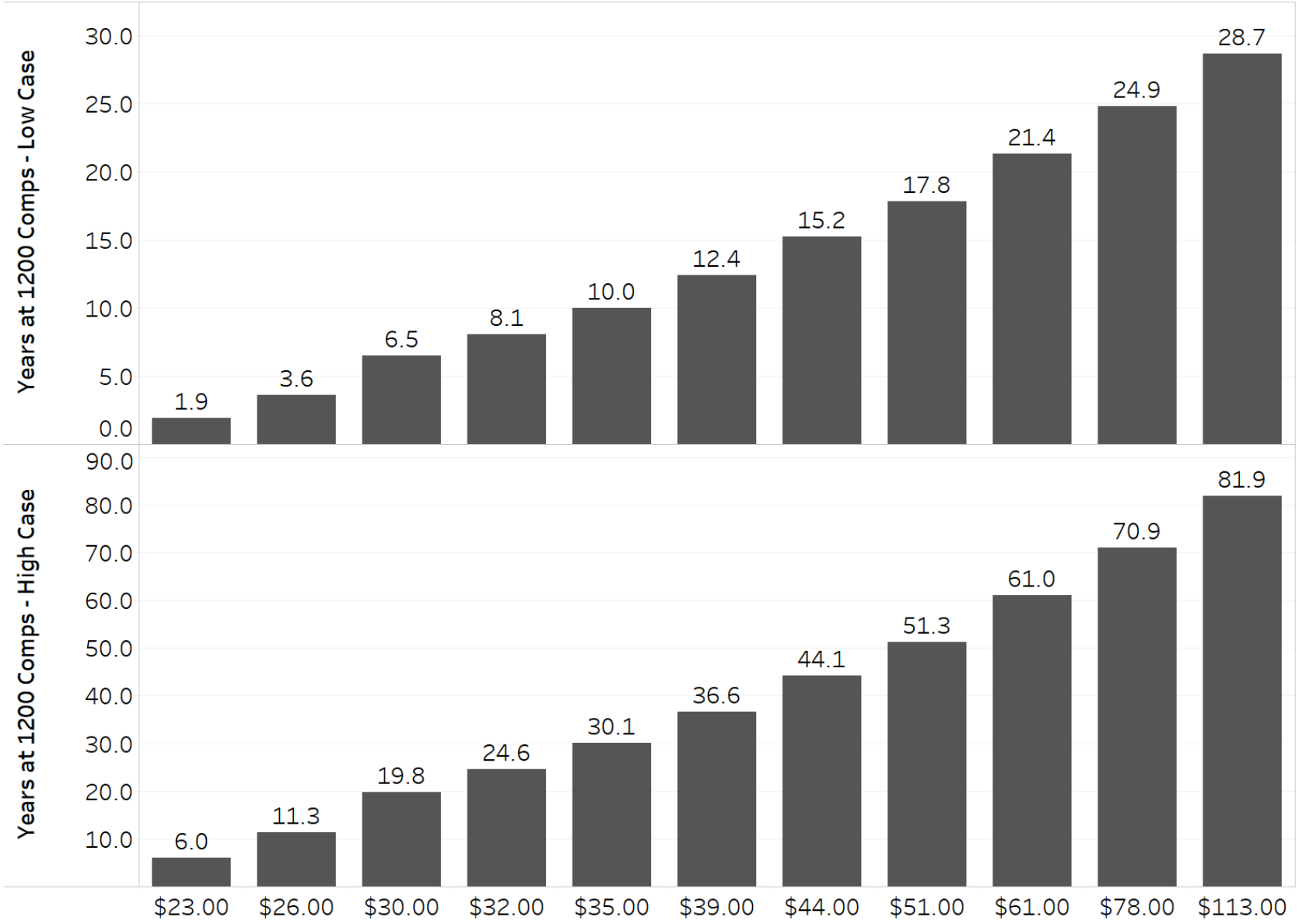


Cumulative Remaining Wells – Peak Month Minimum BOPD



Years Remaining* / Minimum Wellhead Oil Price

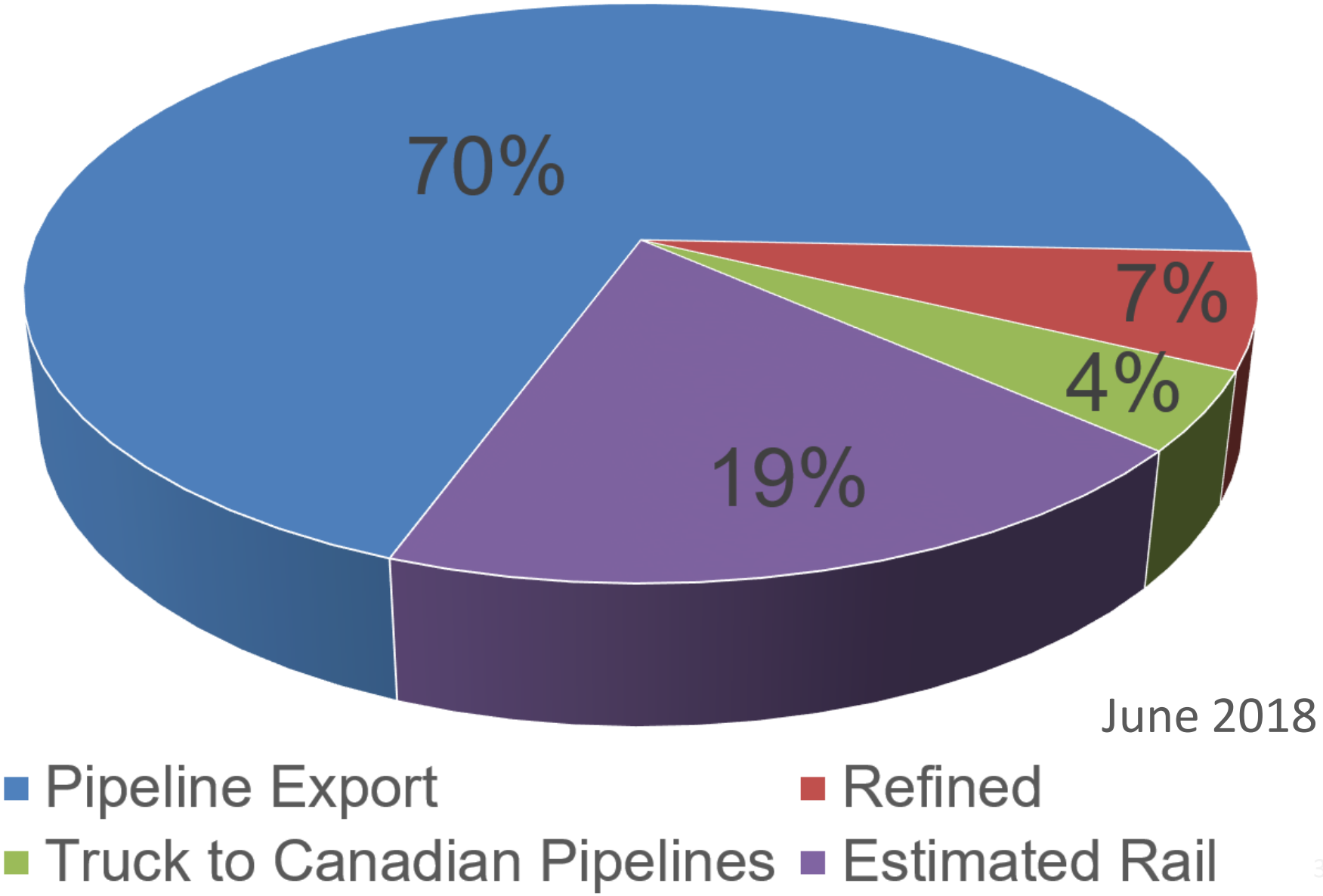
*Assumes 1,200 Completions Per Year and $7MM Well Costs (20% After Tax IRR)



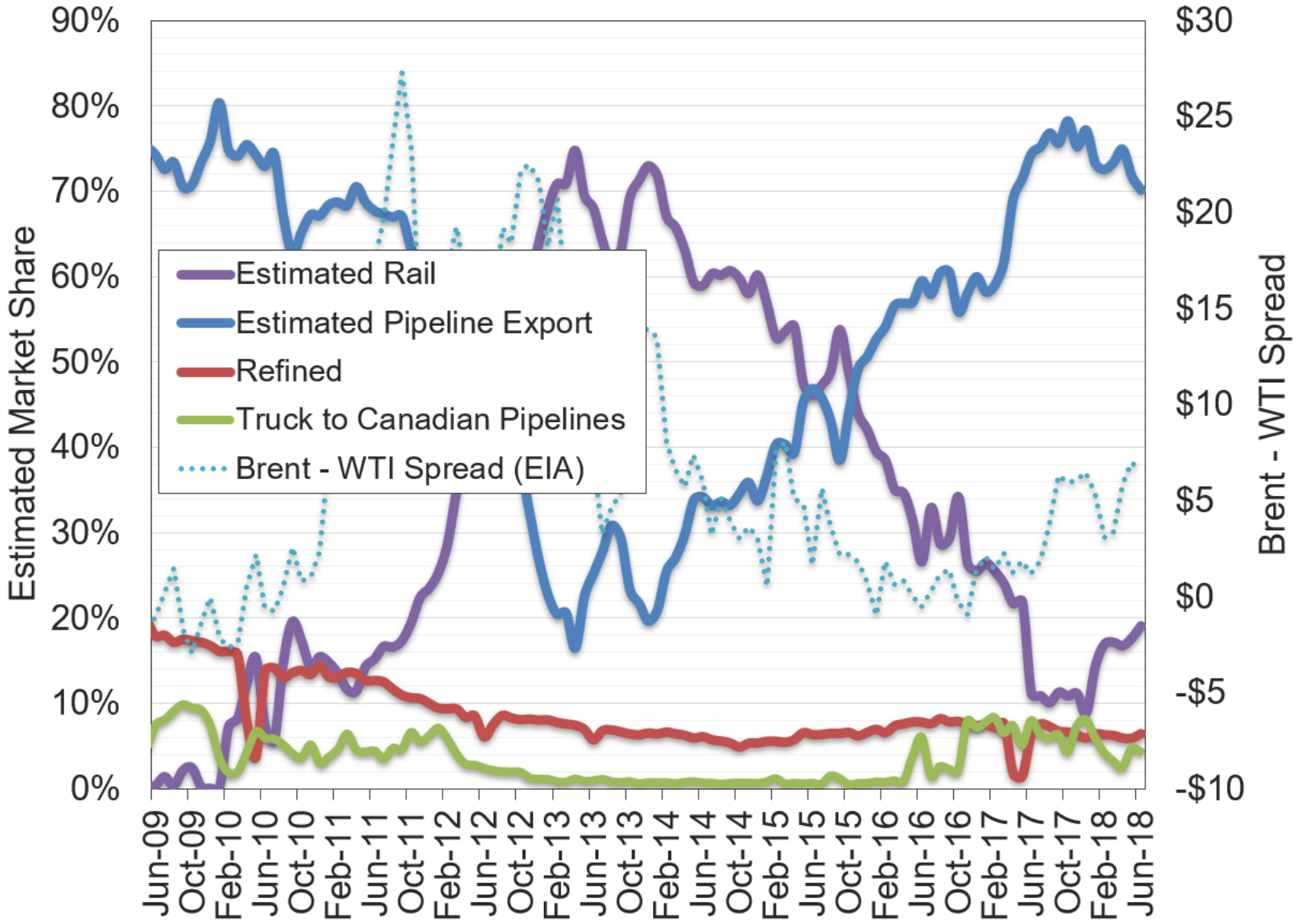
Presentation Outline

- Economics
- **Current Activity and 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

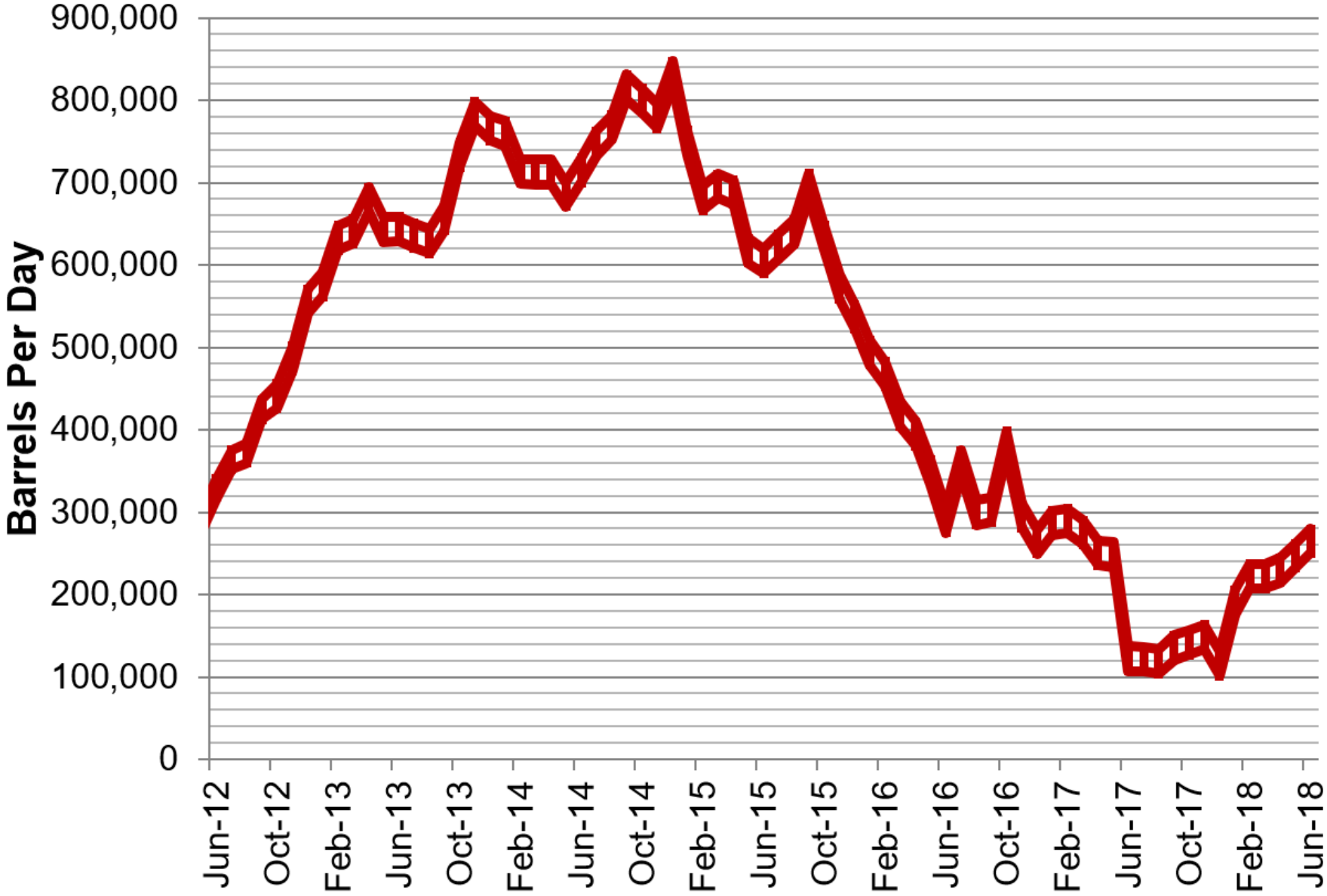
Estimated Williston Basin Oil Transportation



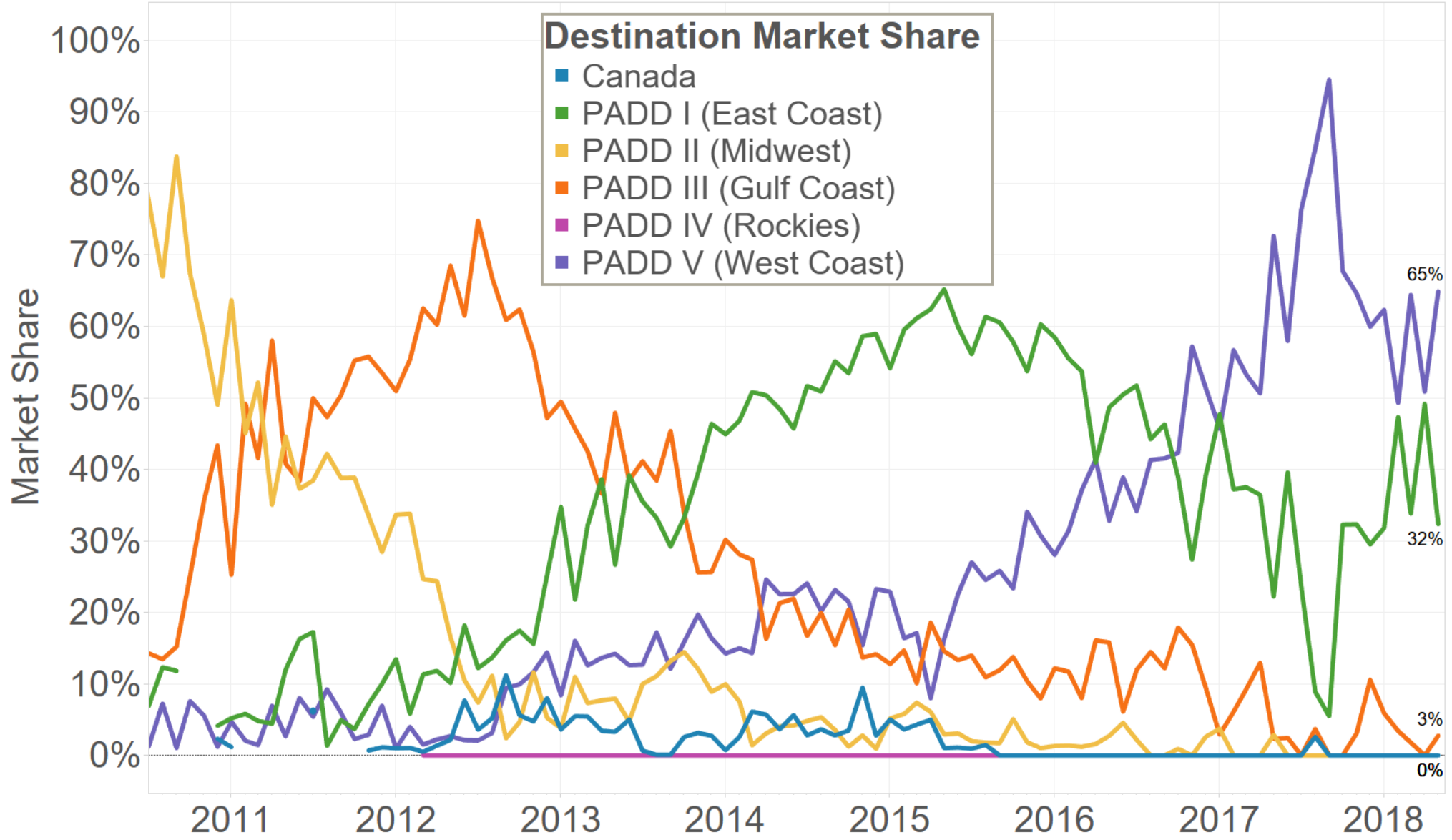
Estimated Williston Basin Oil Transportation



Estimated ND Rail Export Volumes

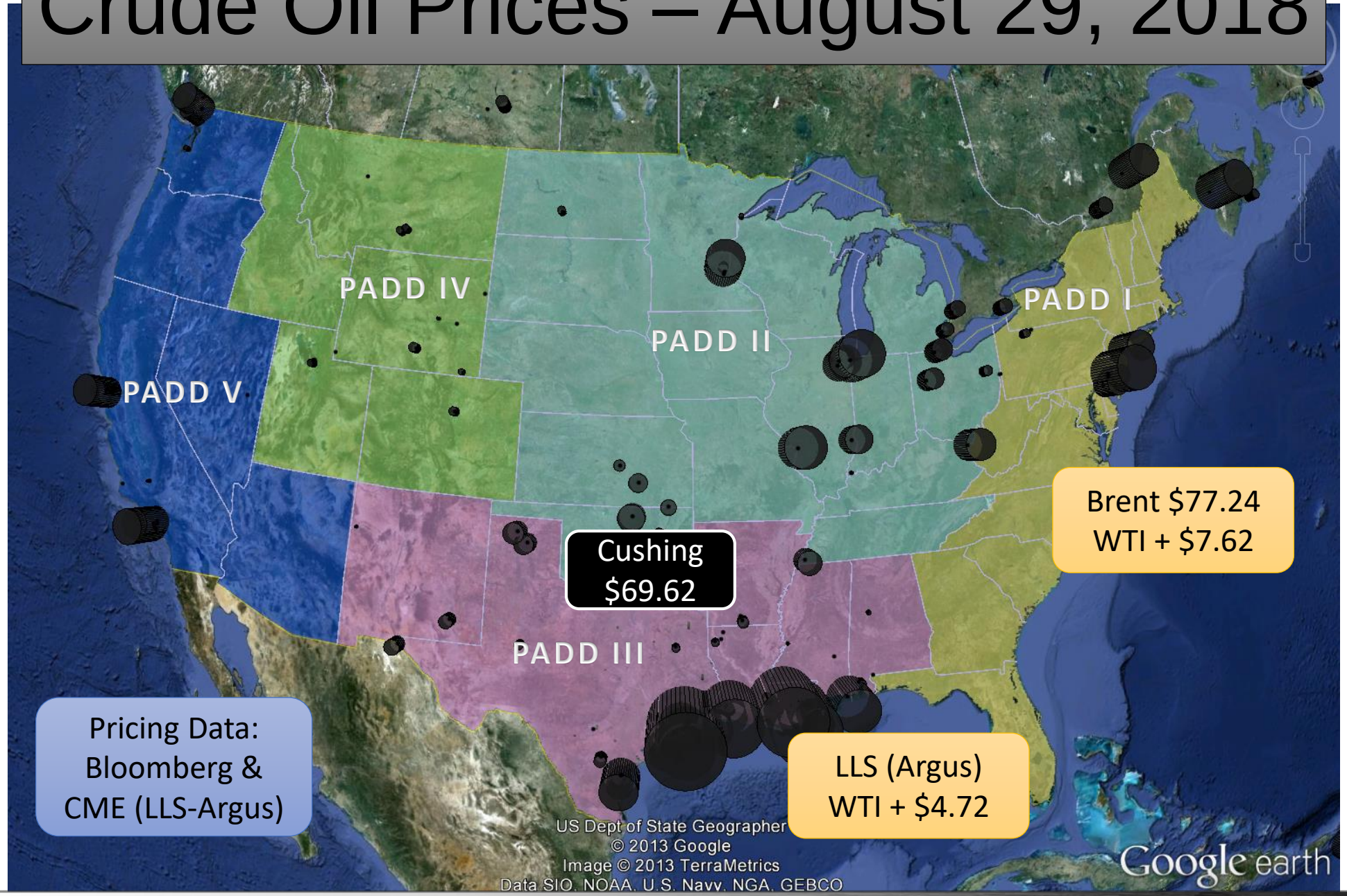


Rail Destinations Market Share (May 2018)



Data for Rail Destination Market Share Provided by the US Energy Information Administration

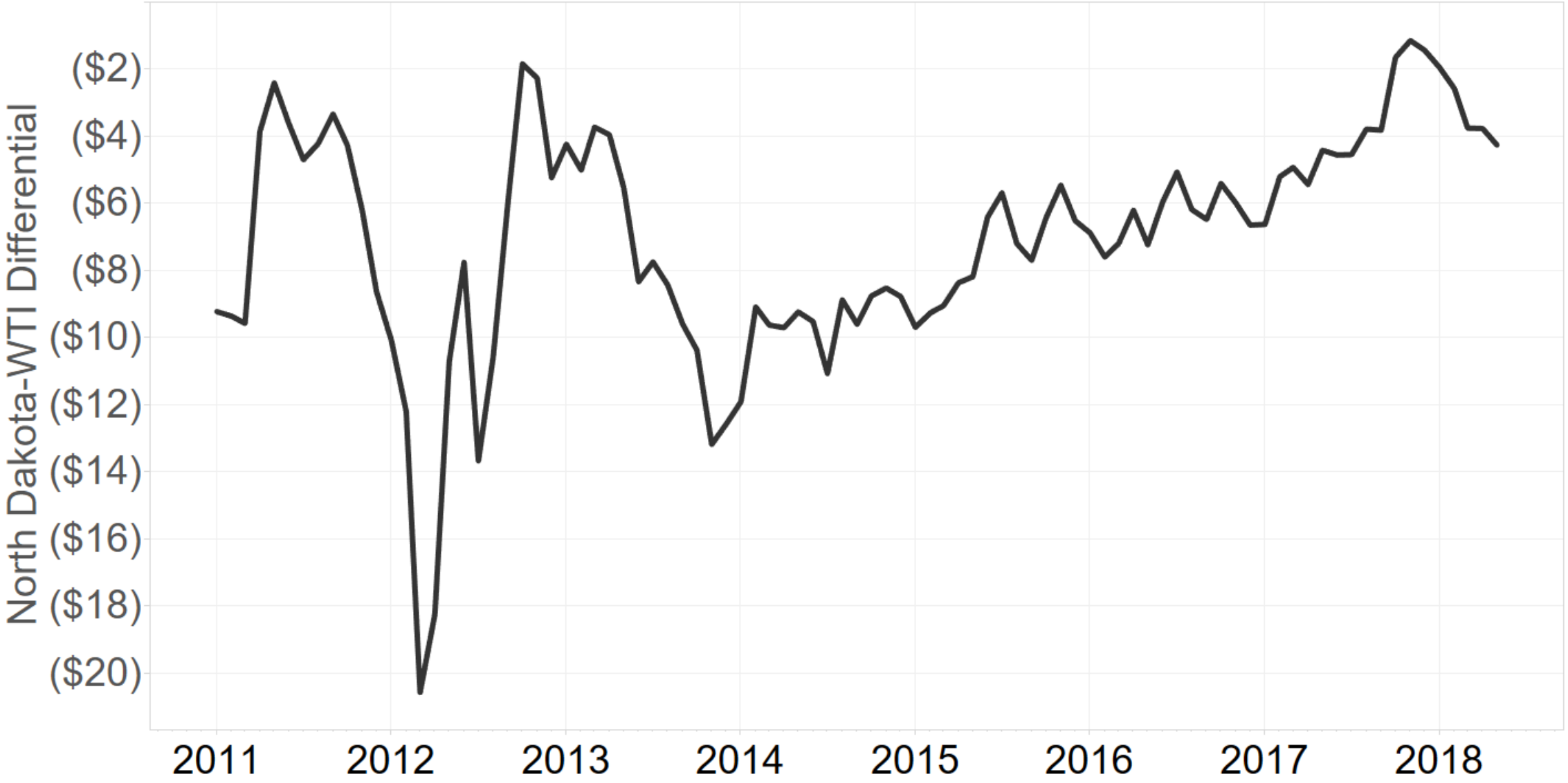
Crude Oil Prices – August 29, 2018



Presentation Outline

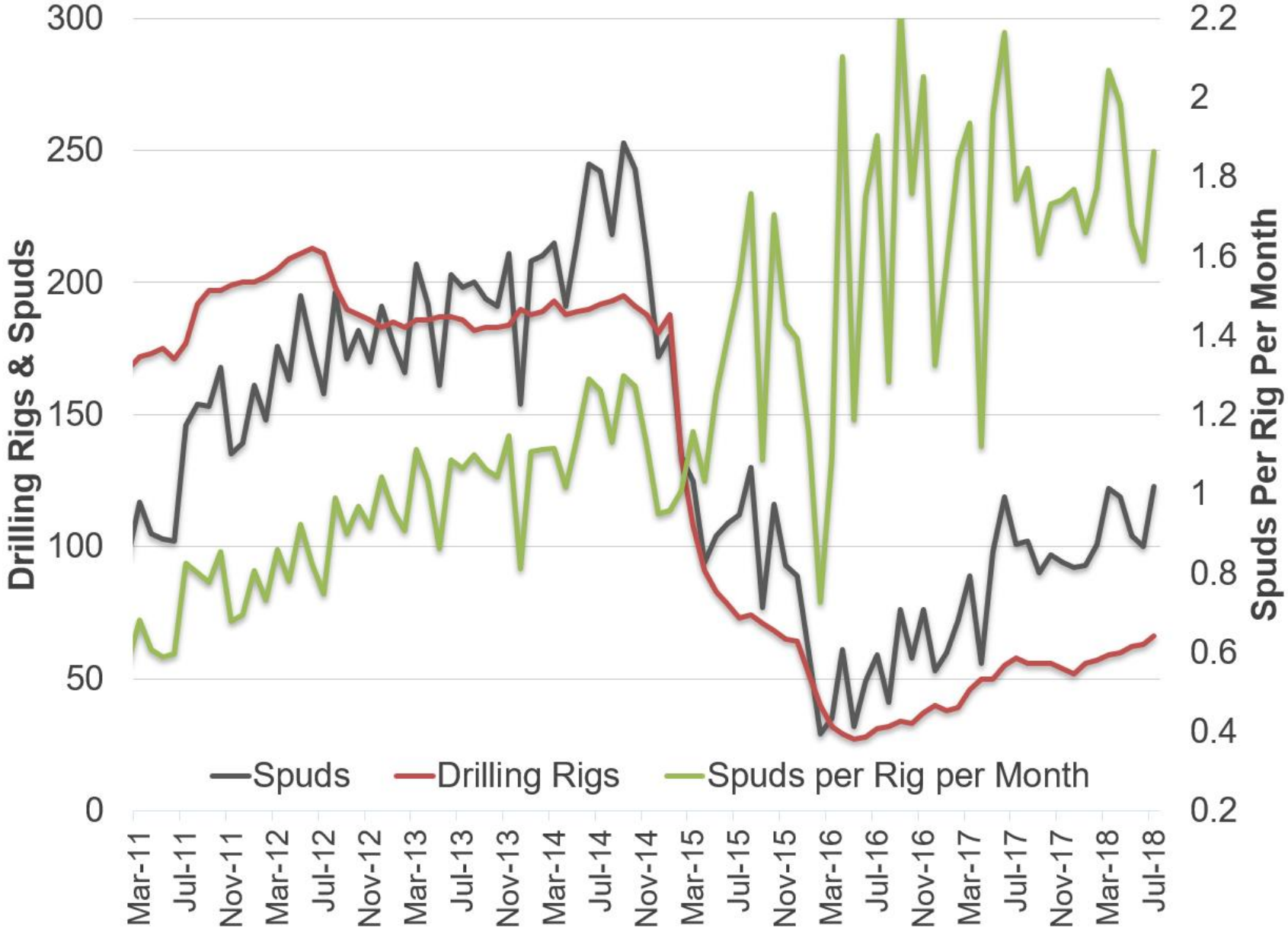
- Economics
- Current Activity and oil transportation dynamics
- **Understanding current and future oil production**
  - **Pricing update**
  - **Activity**
  - **Oil forecasts**
- North Dakota natural gas production
  - Flaring and gas capture
  - Natural gas liquids
- Pipeline construction update

North Dakota Oil Differential* to WTI

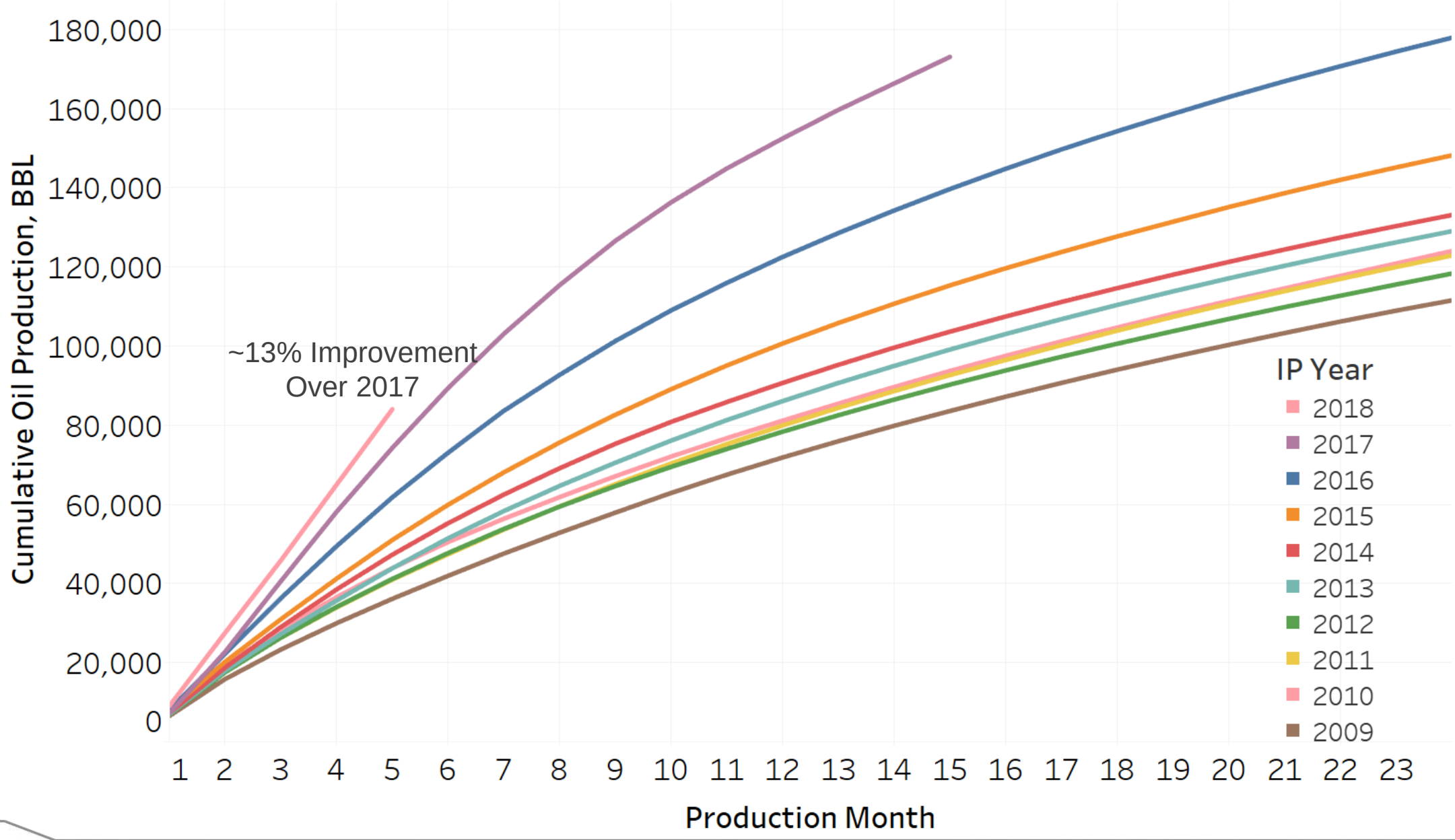


*DATA: EIA First Purchaser

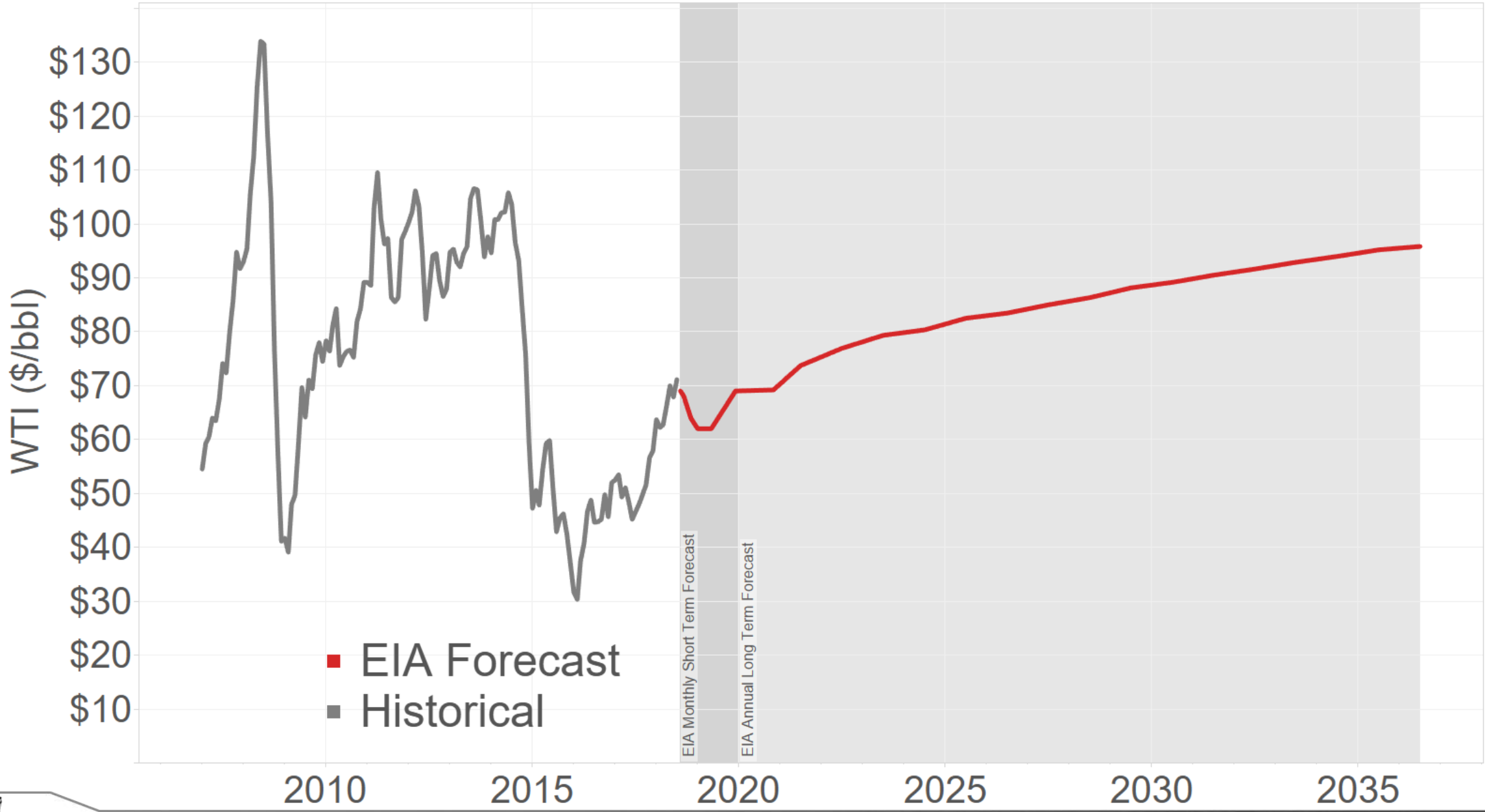
North Dakota Drilling Activity



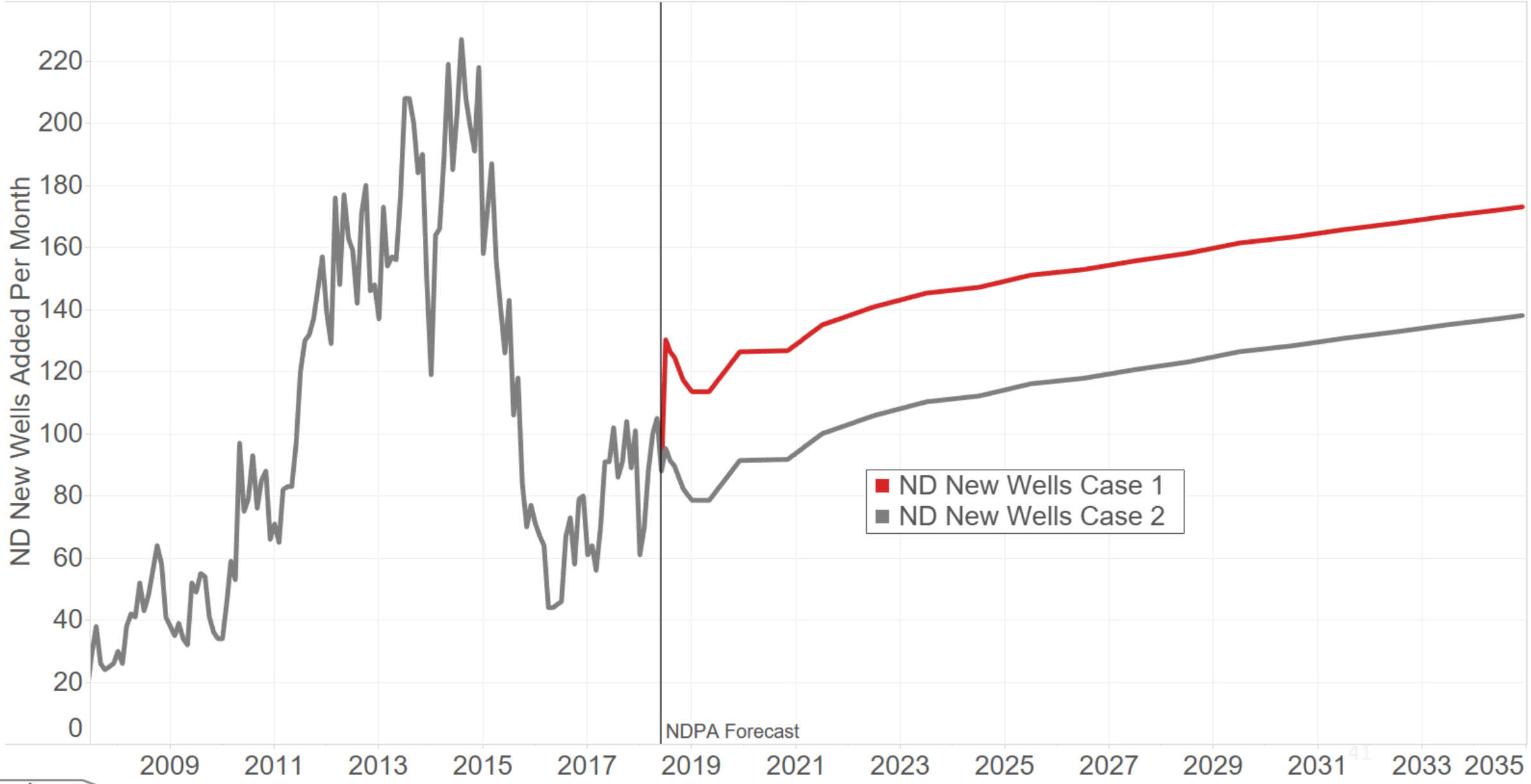
Statewide Oil Performance



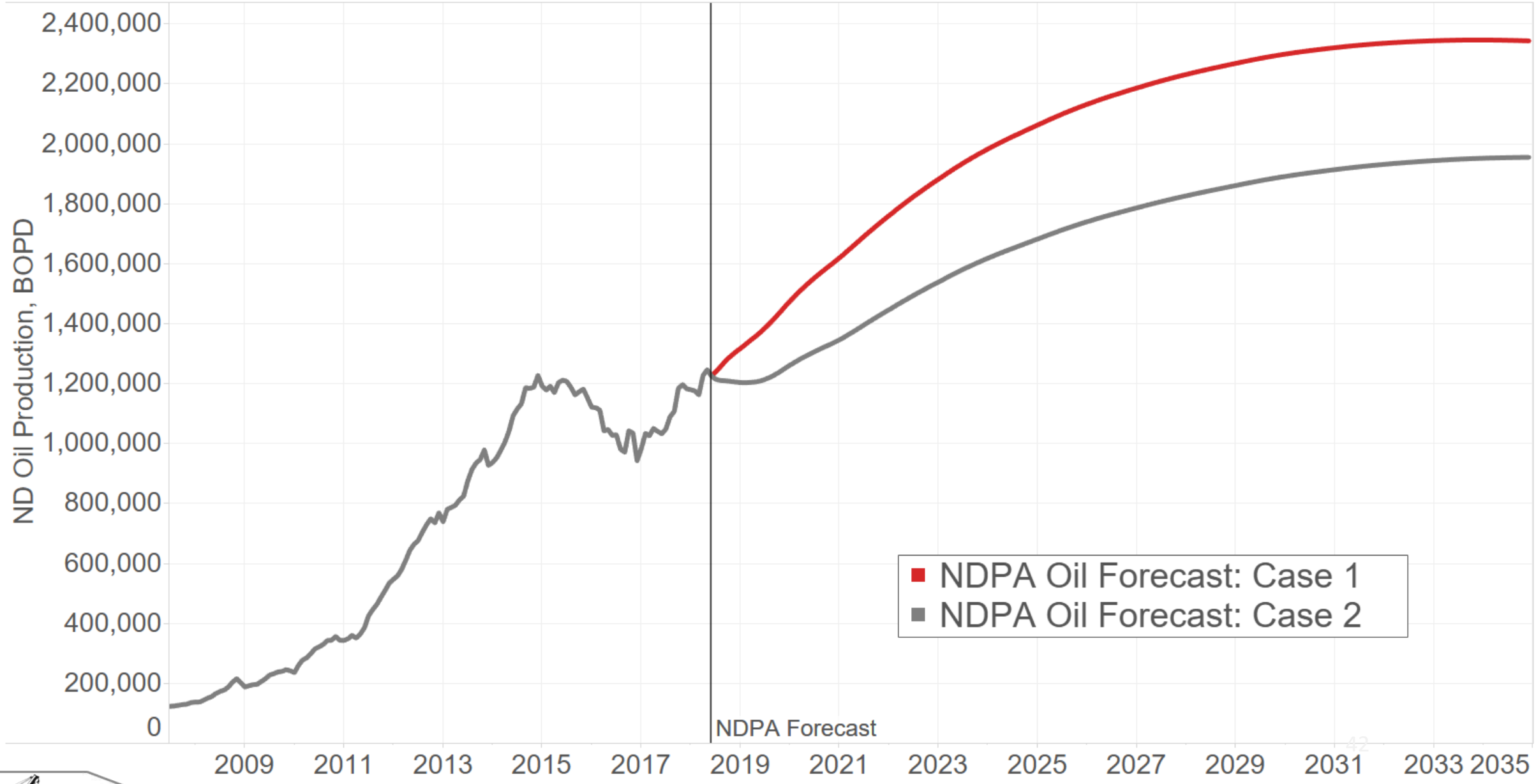
DOE-EIA Forecasted Oil Price



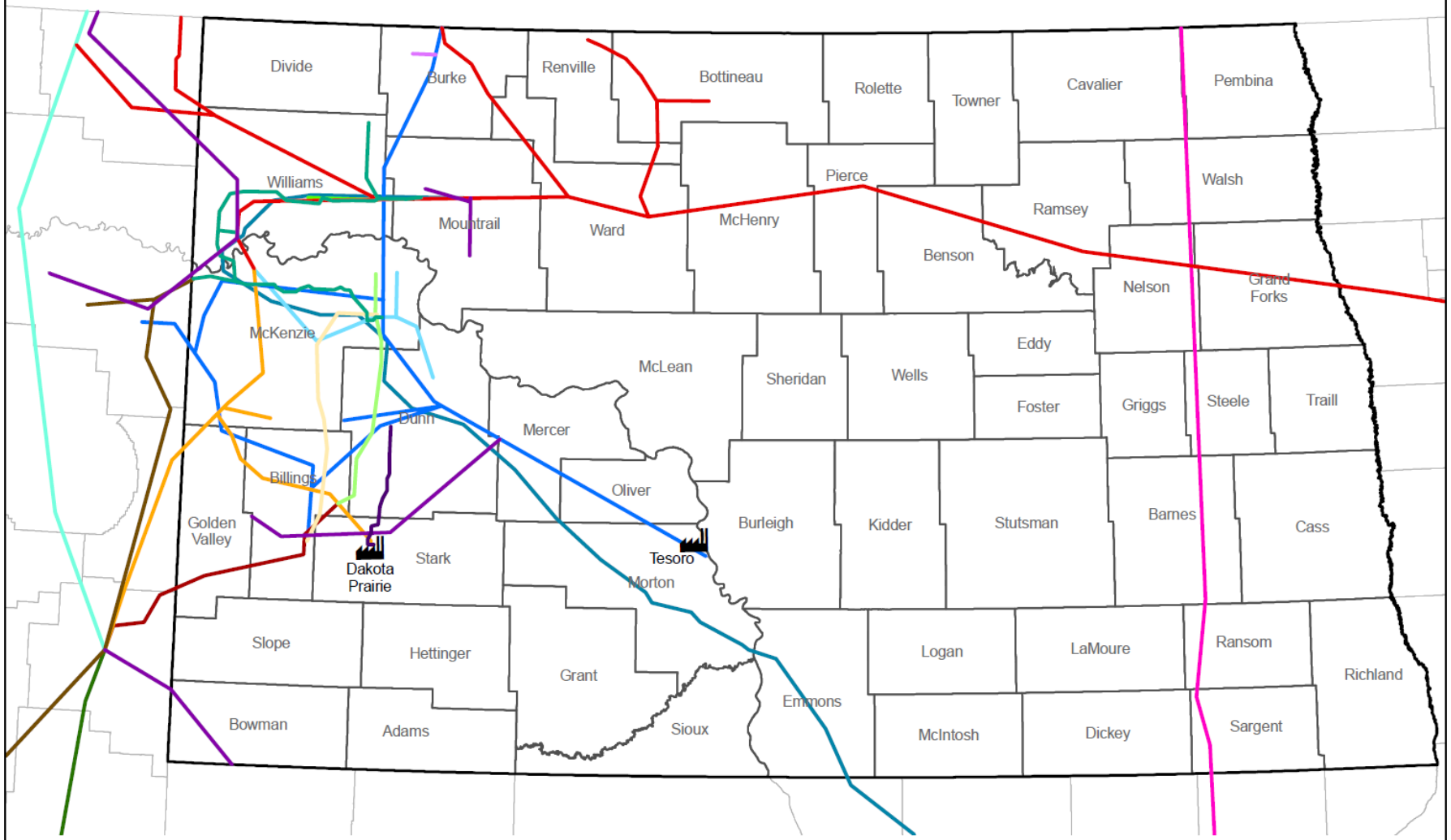
North Dakota Forecast Activity Assumptions



North Dakota Oil Production Forecast

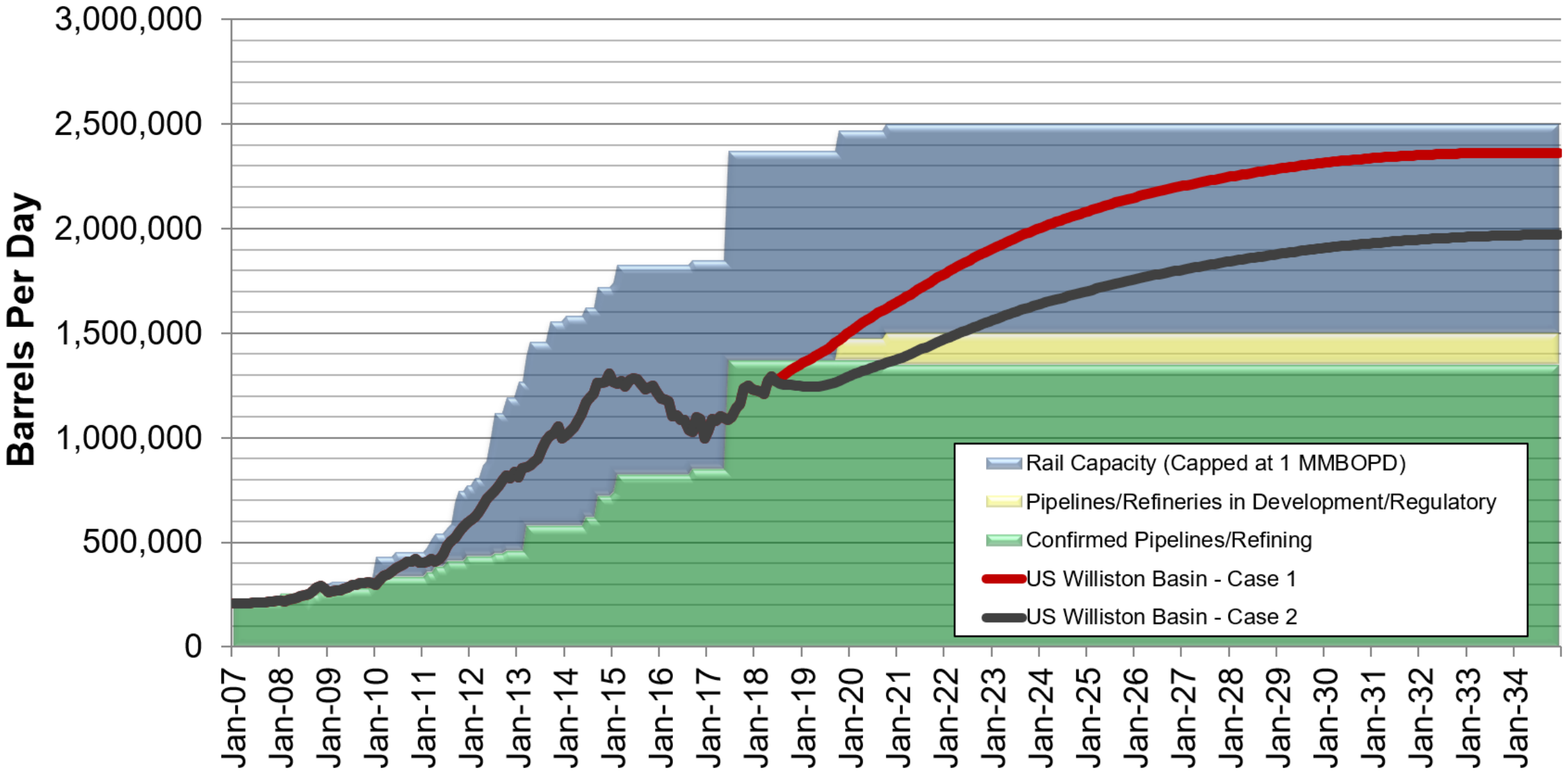


North Dakota Crude Oil Pipelines



Date: 6/2/2017

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.

Presentation Outline

- Economics
- Current Activity and 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

Natural Gas Update

Production

- Technology
- Markets

Gathering

- Capacity
- Connections

Processing

- Capacity
- Location

Transmission

- Dry Gas
- Natural Gas Liquids

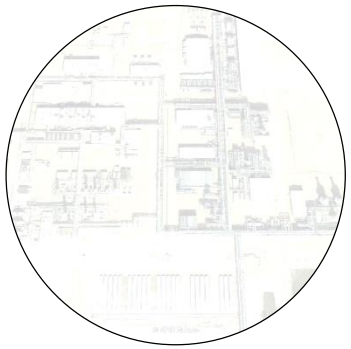
Natural Gas Update

Production

- Technology
- Markets

Gathering

- Capacity
- Connections



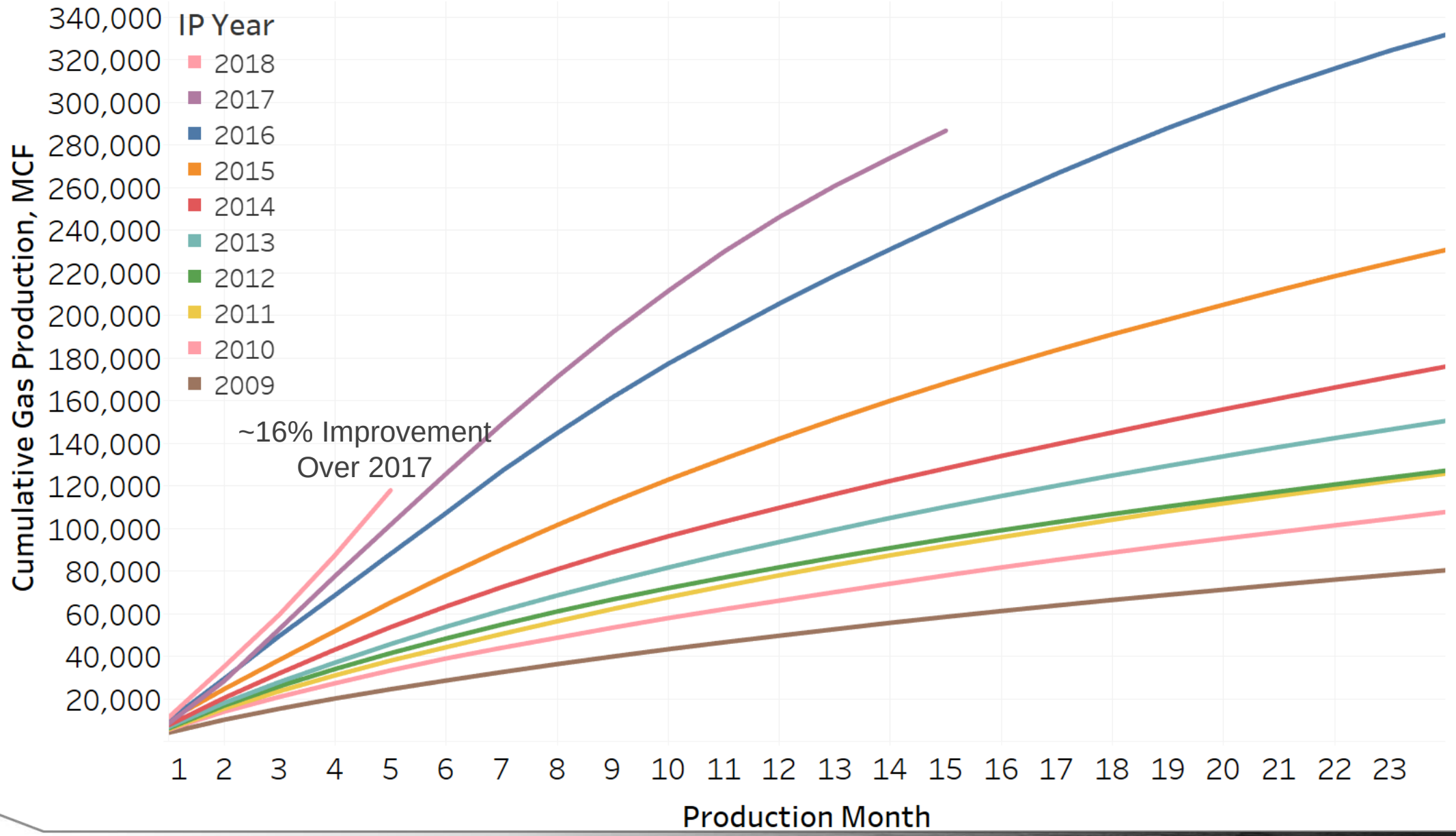
Processing

- Capacity
- Location

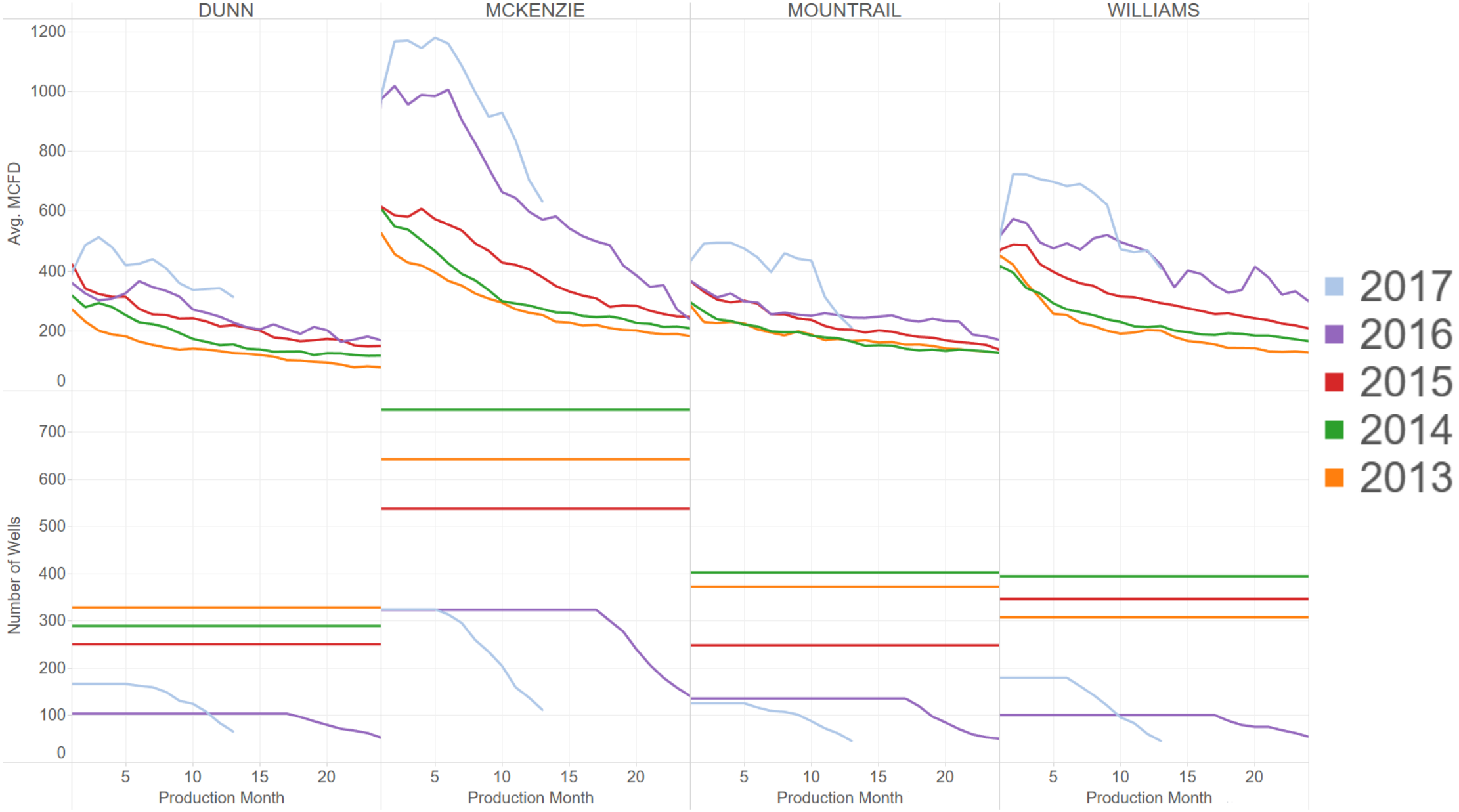
Transmission

- Dry Gas
- Natural Gas Liquids

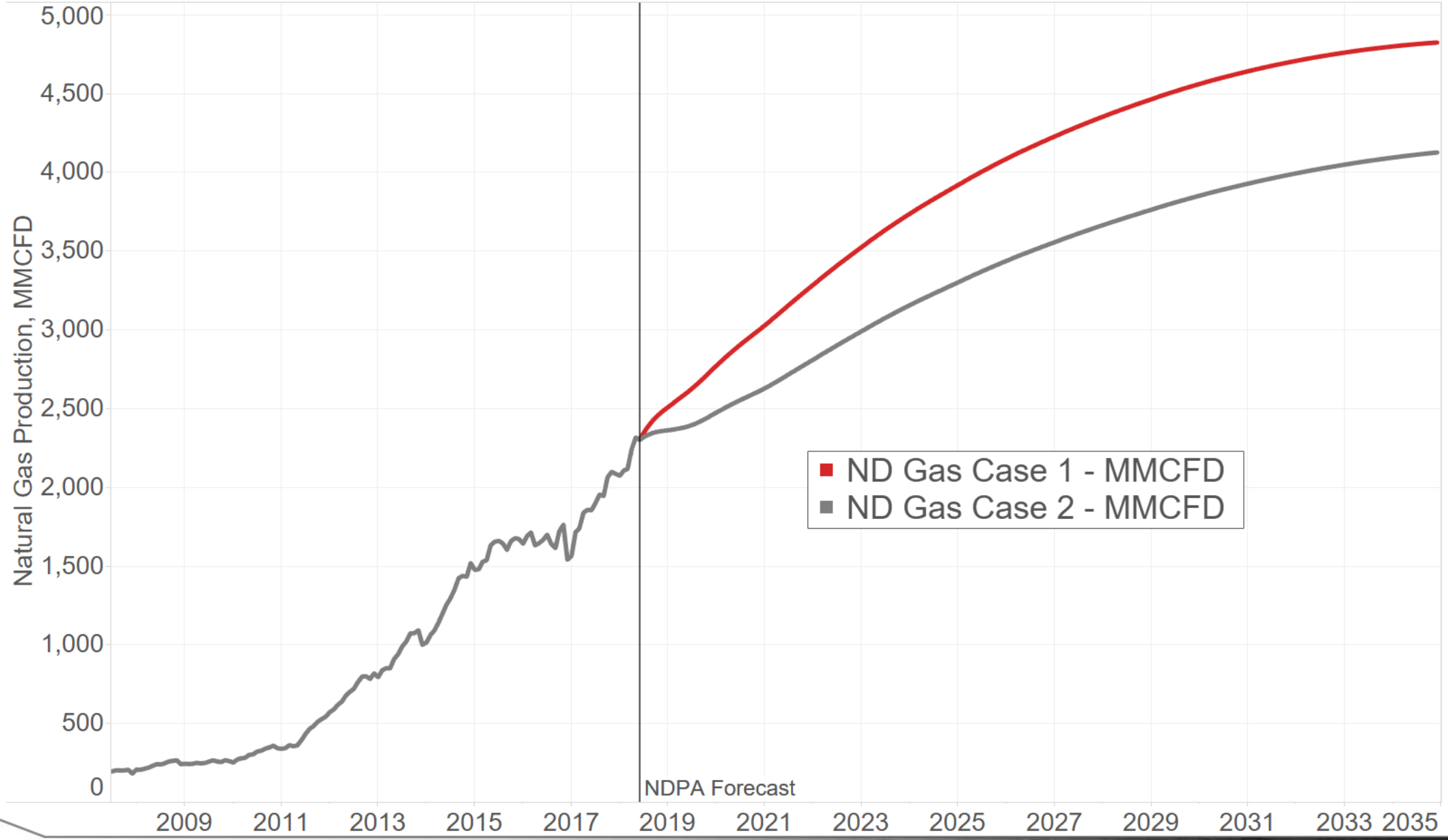
Statewide Gas Performance



Bakken and Three Forks Well Performance



NDPA North Dakota Gas Production Forecast



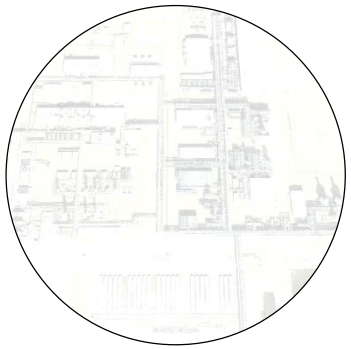
Natural Gas Update

Production

- Technology
- Markets

Gathering

- Capacity
- Connections



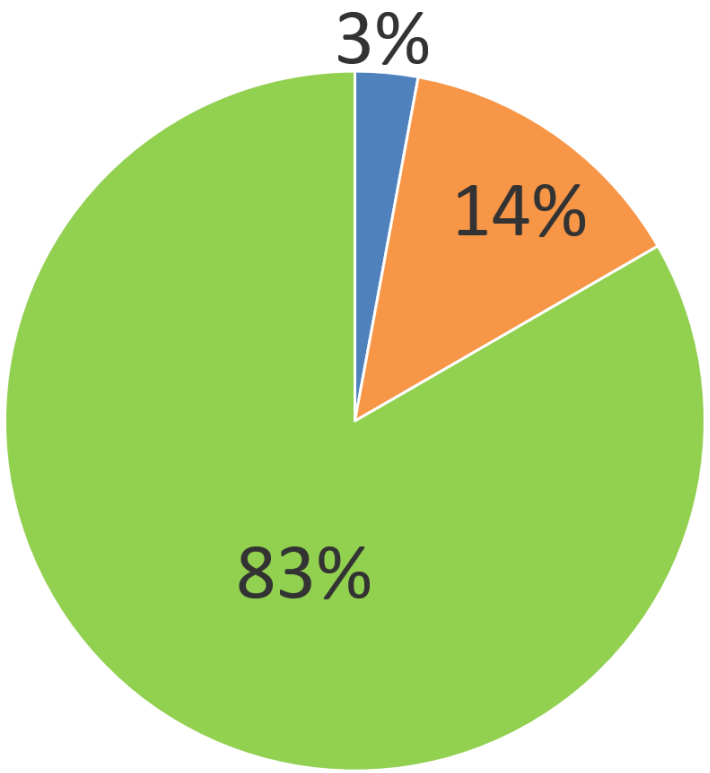
Processing

- Capacity
- Location

Transmission

- Dry Gas
- Natural Gas Liquids

Solving the Flaring Challenge



Statewide

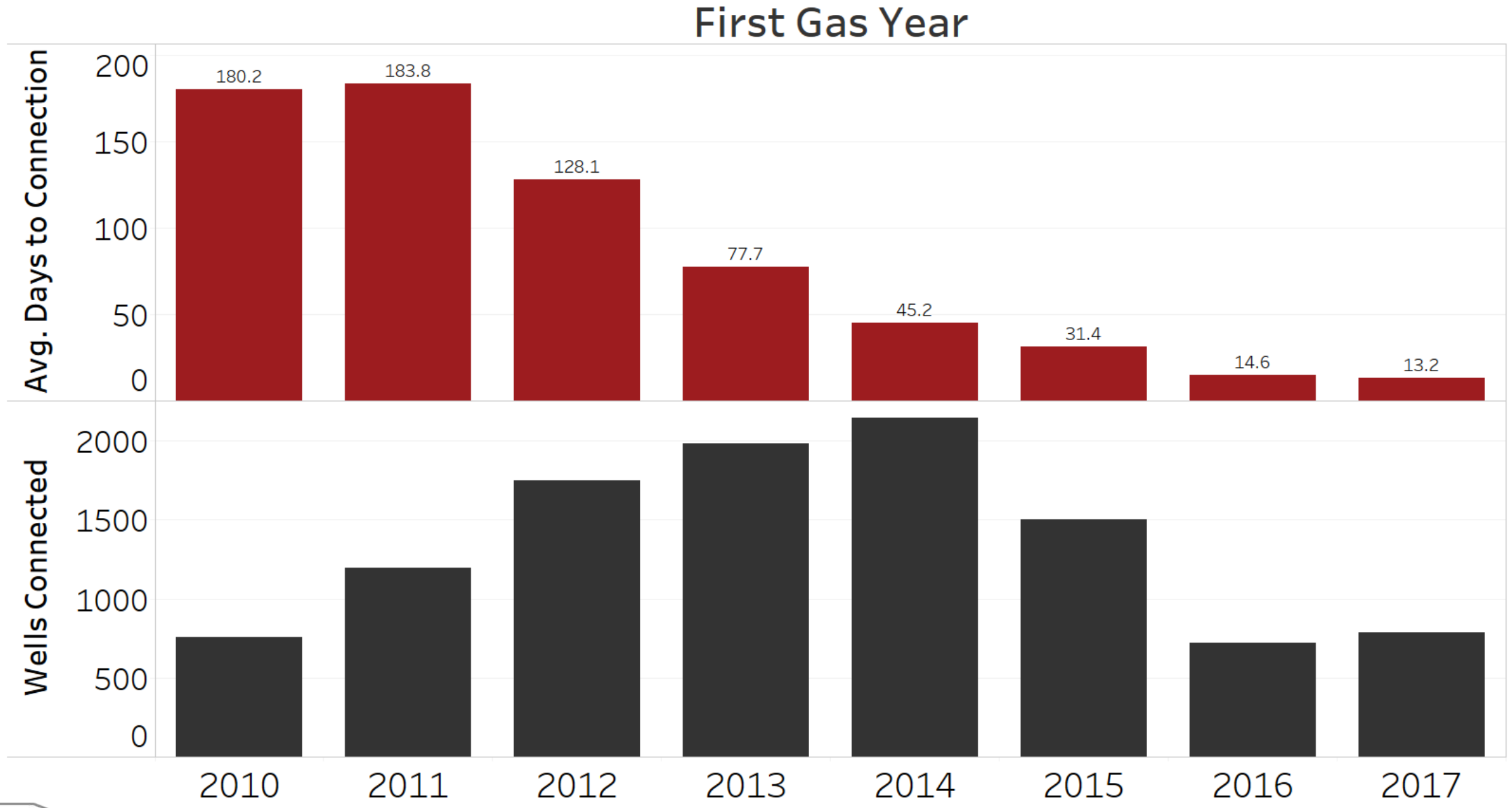
GREEN – % of gas captured and sold
Blue – % flared from zero sales wells
Orange – % flared from wells with at least one mcf sold.

Simple Terms

Blue – Lack of pipelines
Orange – Challenges on existing infrastructure

June 2018 Data – Non-Confidential Wells

Days to Connect to Gas Gathering



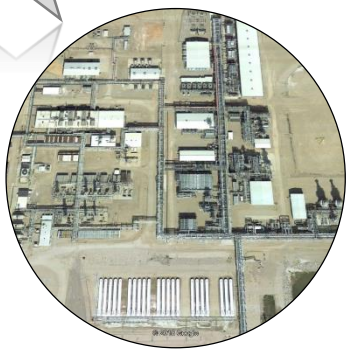
Natural Gas Update

Production

- Technology
- Markets

Gathering

- Capacity
- Connections



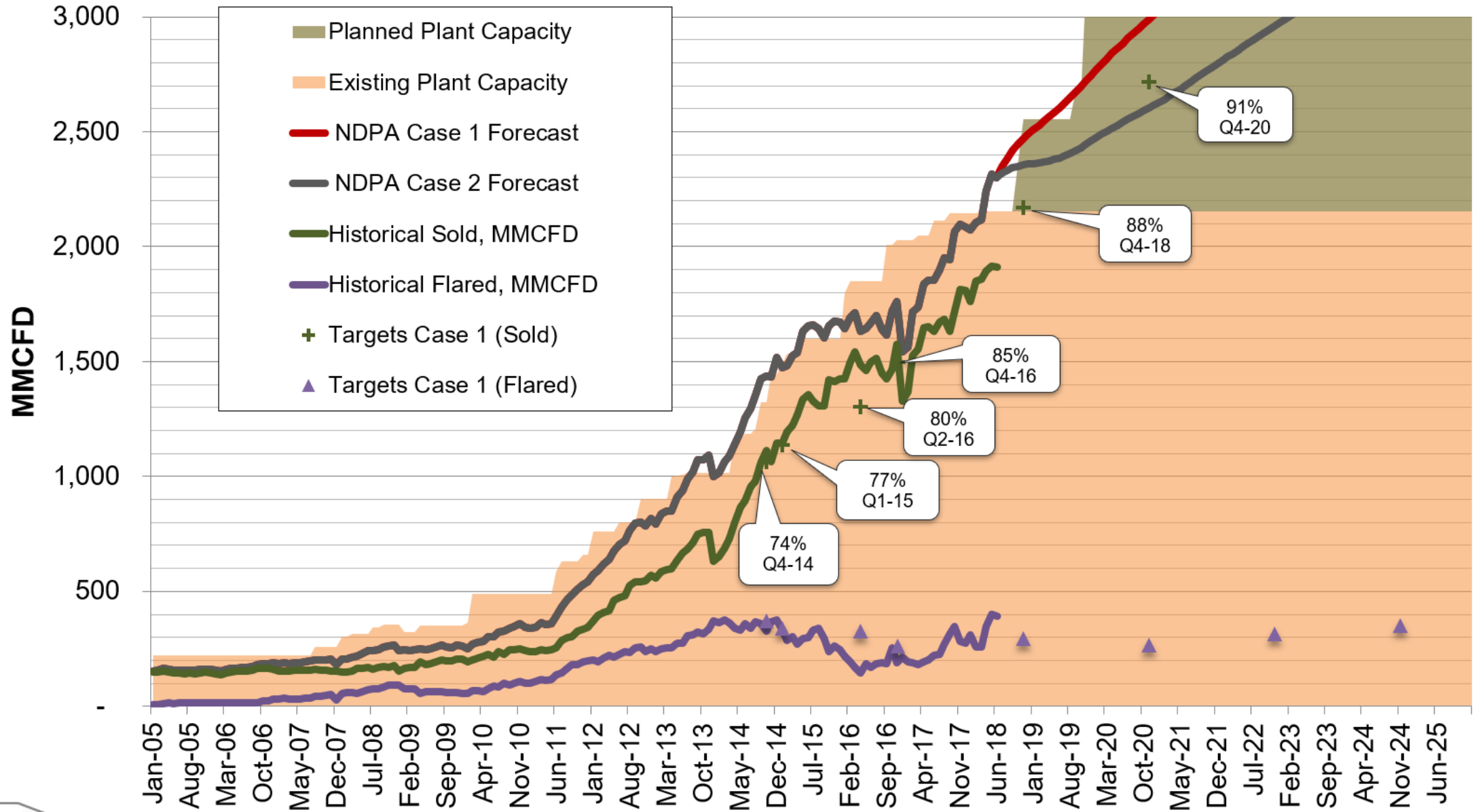
Processing

- Capacity
- Location

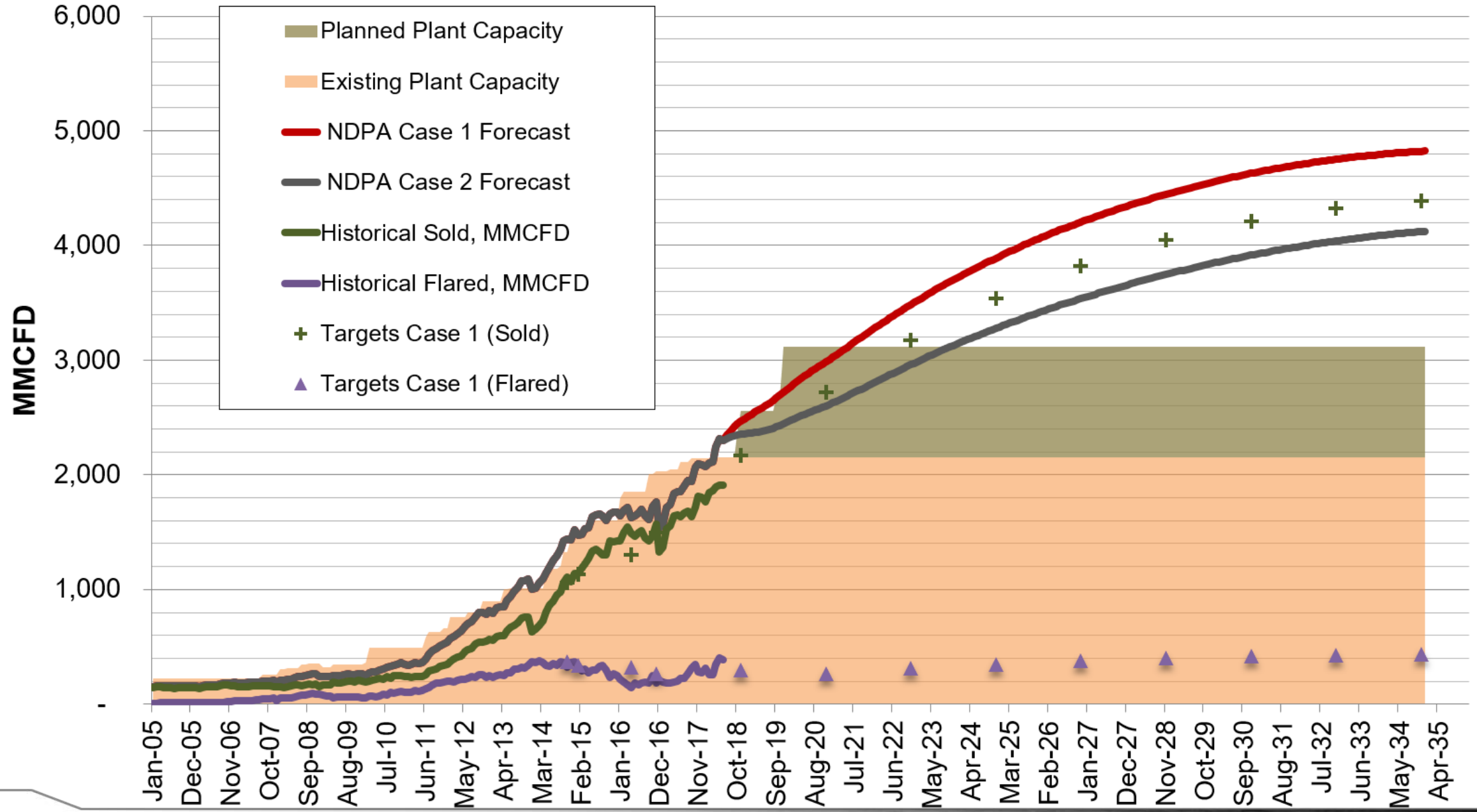
Transmission

- Dry Gas
- Natural Gas Liquids

Solving the Flaring Challenge



Solving the Flaring Challenge



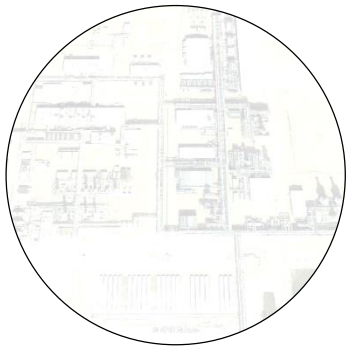
Natural Gas Update

Production

- Technology
- Markets

Gathering

- Capacity
- Connections



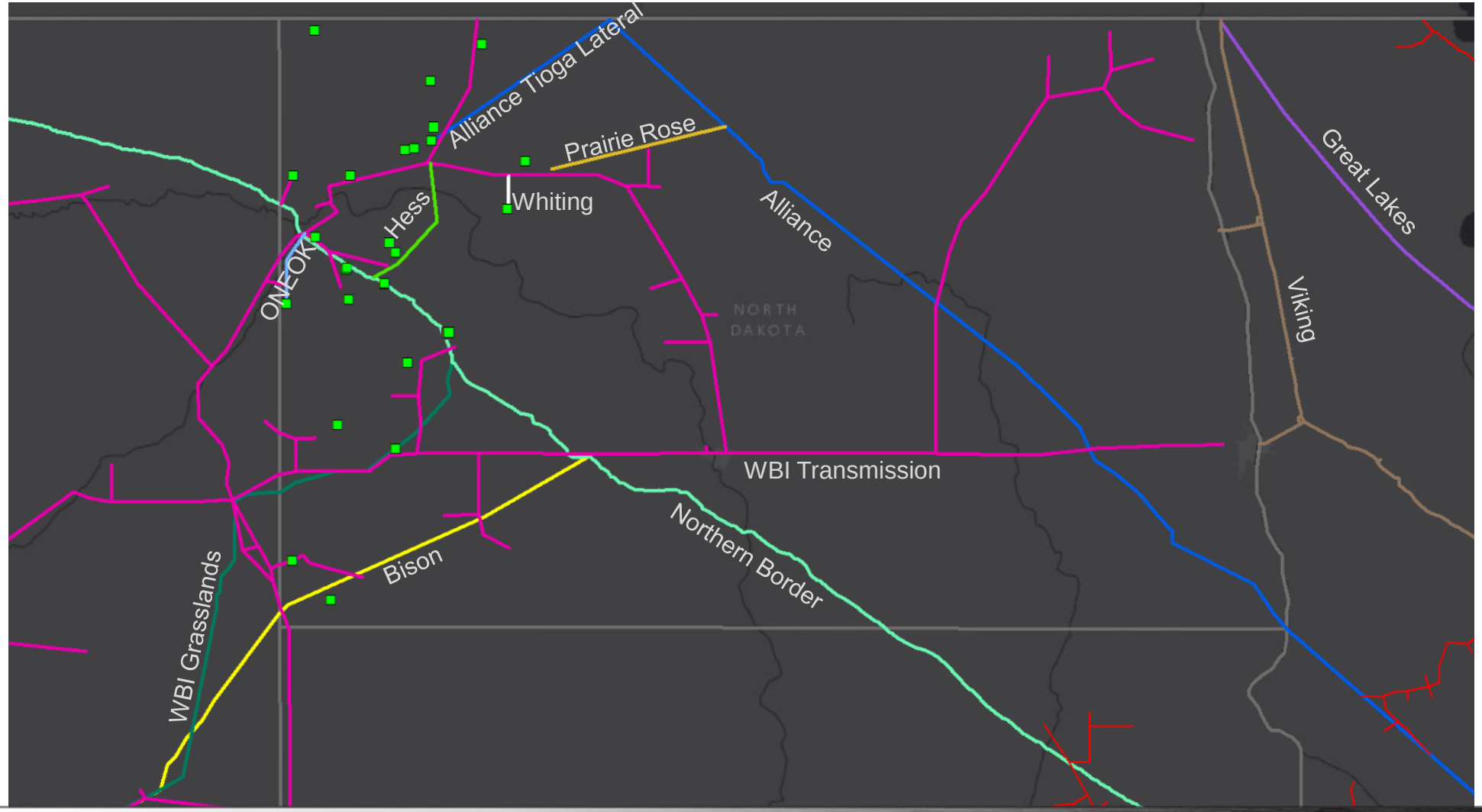
Processing

- Capacity
- Location

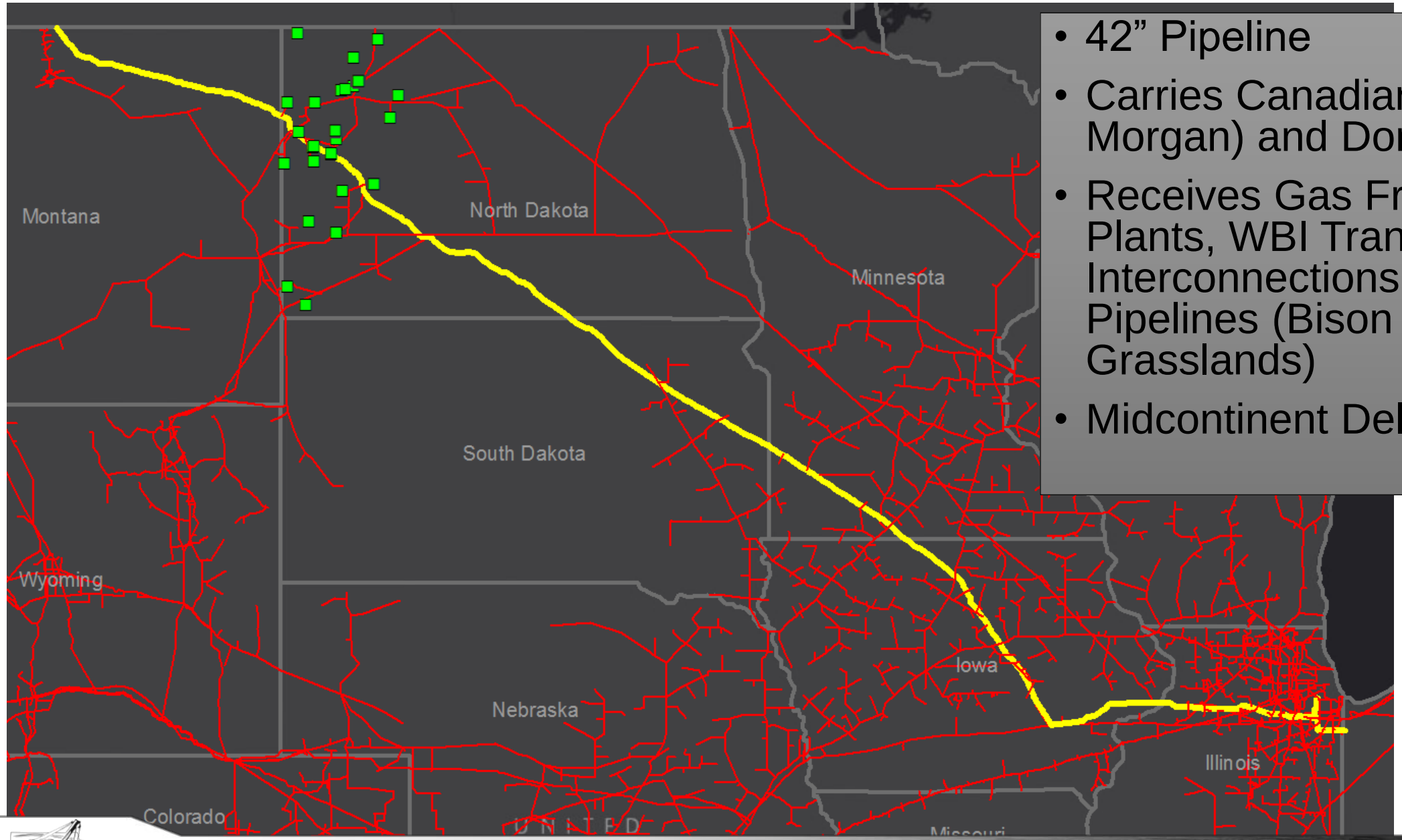
Transmission

- Dry Gas
- Natural Gas Liquids

Major Gas Pipeline and Processing Infrastructure



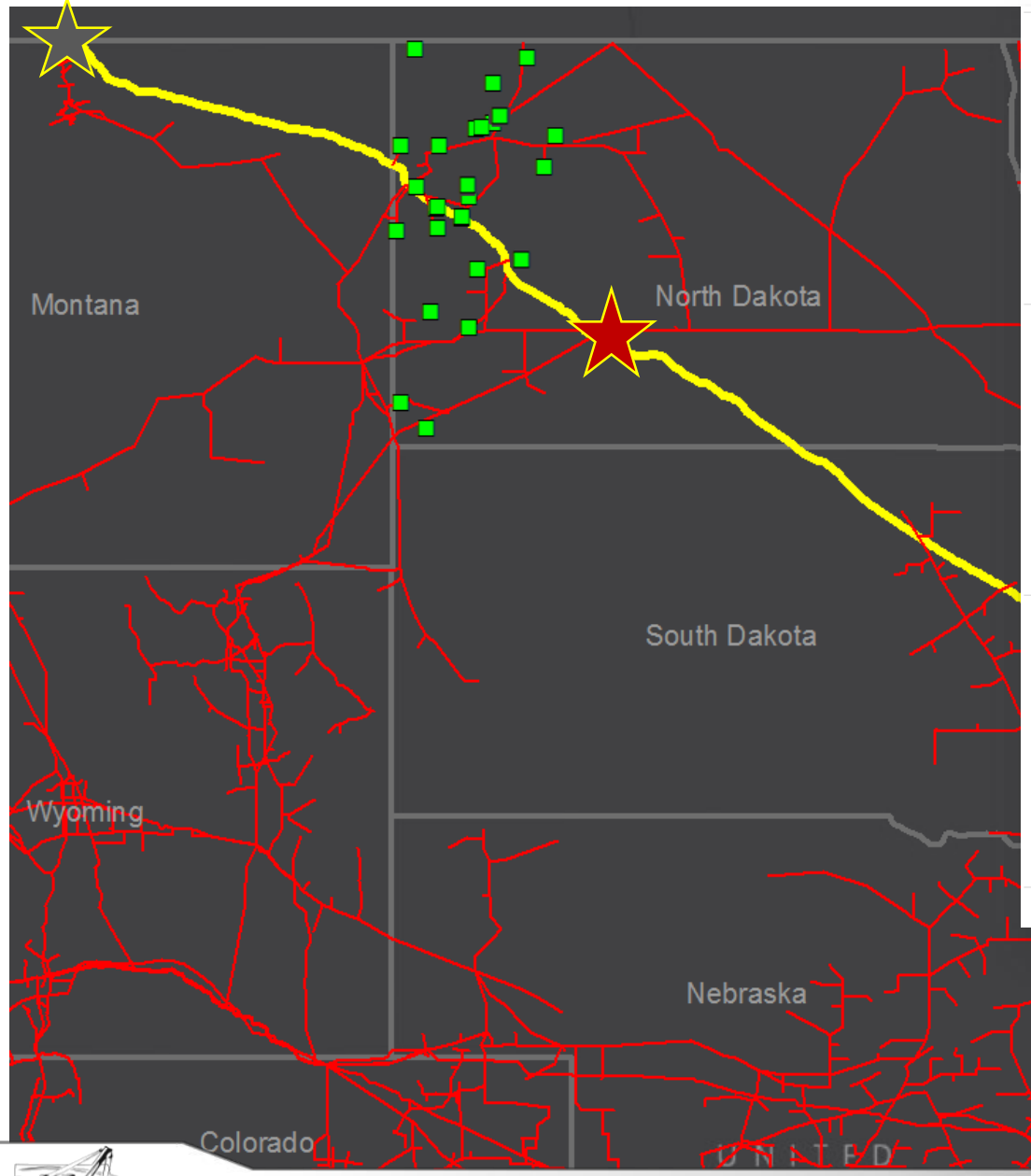
Northern Border Pipeline

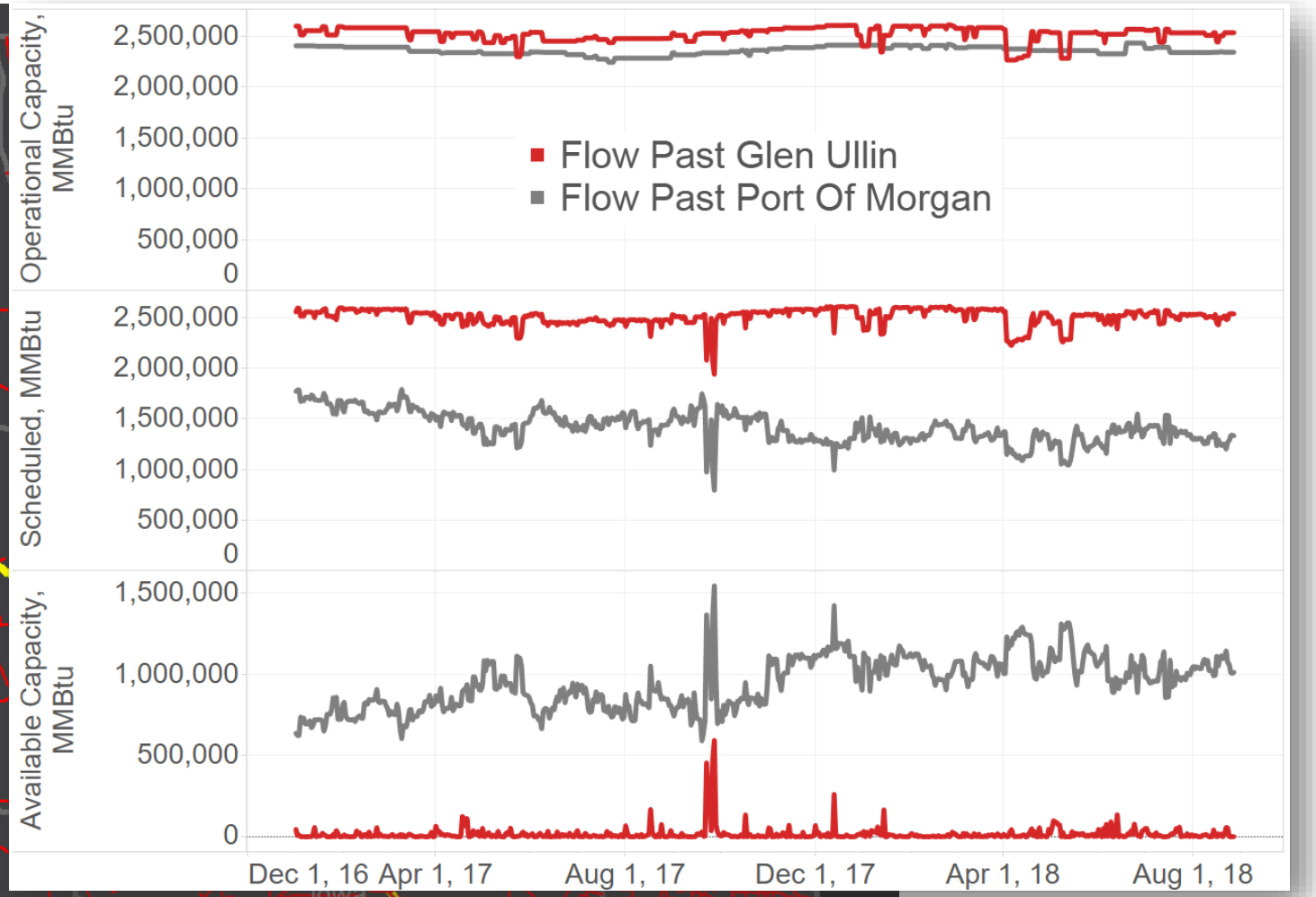


- 42” Pipeline
- Carries Canadian (Port of Morgan) and Domestic Gas
- Receives Gas From ND Plants, WBI Transmission Interconnections, and WY Pipelines (Bison & Grasslands)
- Midcontinent Deliveries

*Data Source: Northern Border IPS

Northern Border Pipeline

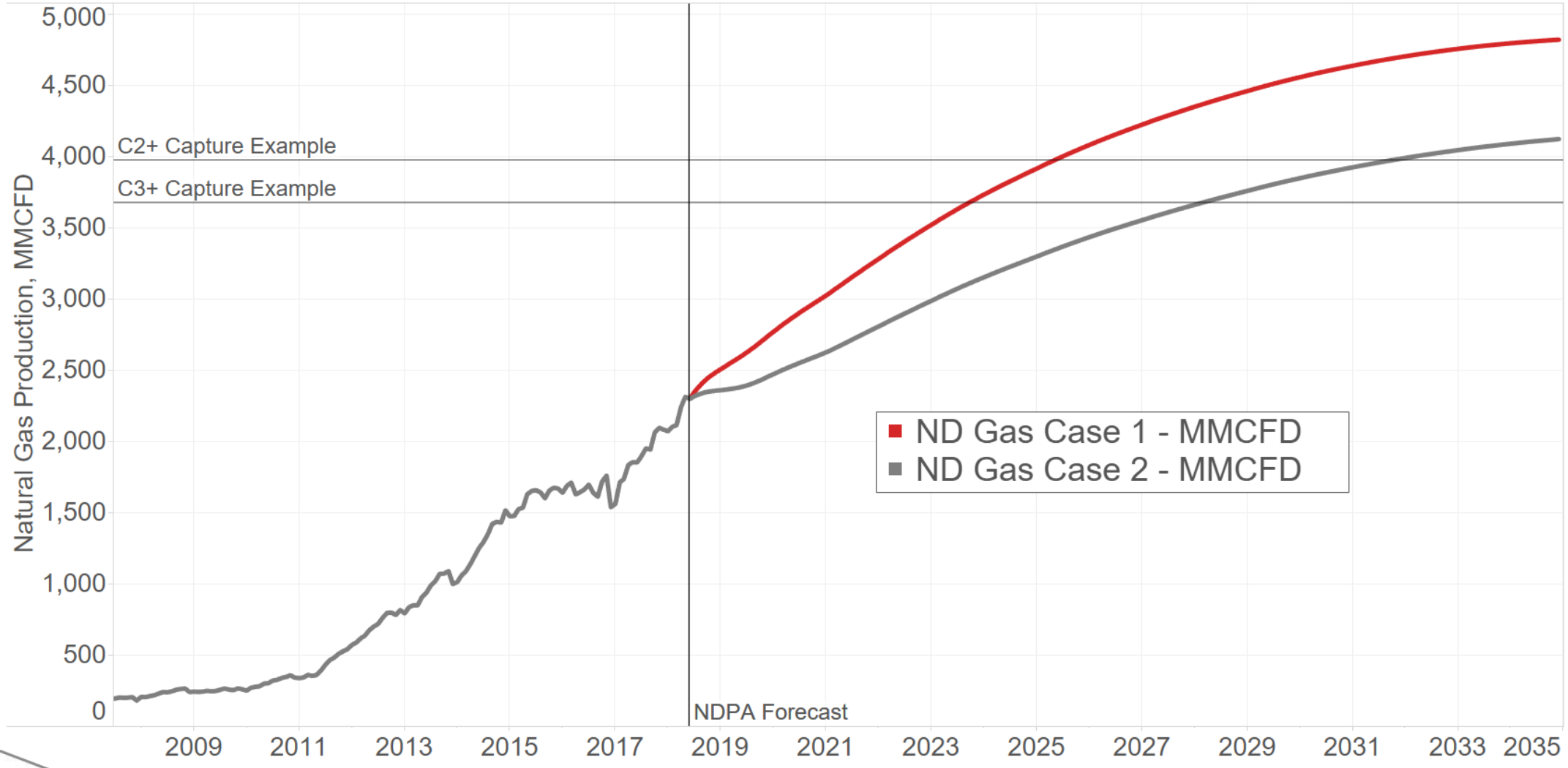




*Data Source: Northern Border IPS

Simplified Example NB Calculations

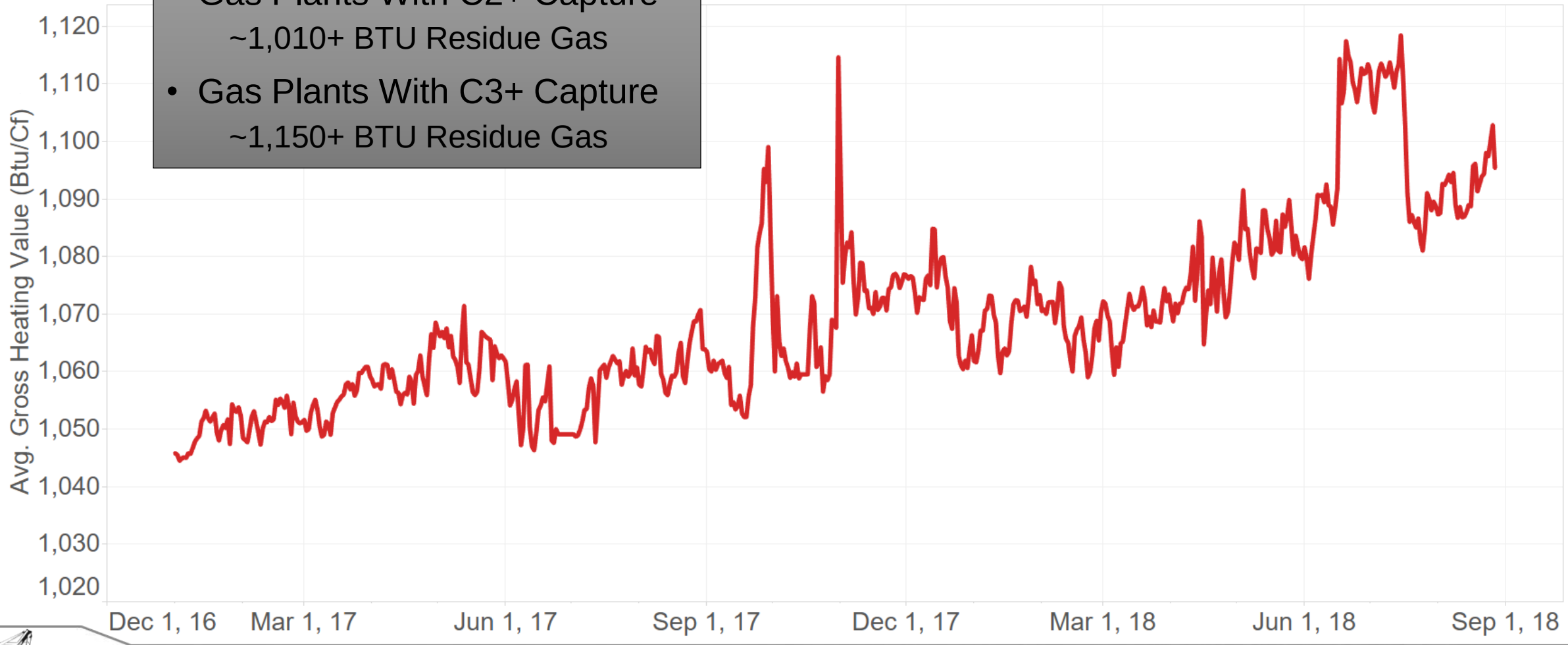
Conclusion: **IF** no other gas export options open and all other deliveries on other pipelines stay static, ND gas production could increase 1.38-1.68 BCFD (from June-18) before Northern Border is 100% Bakken production. **BTU management becomes increasingly important for Bakken residue gas.**



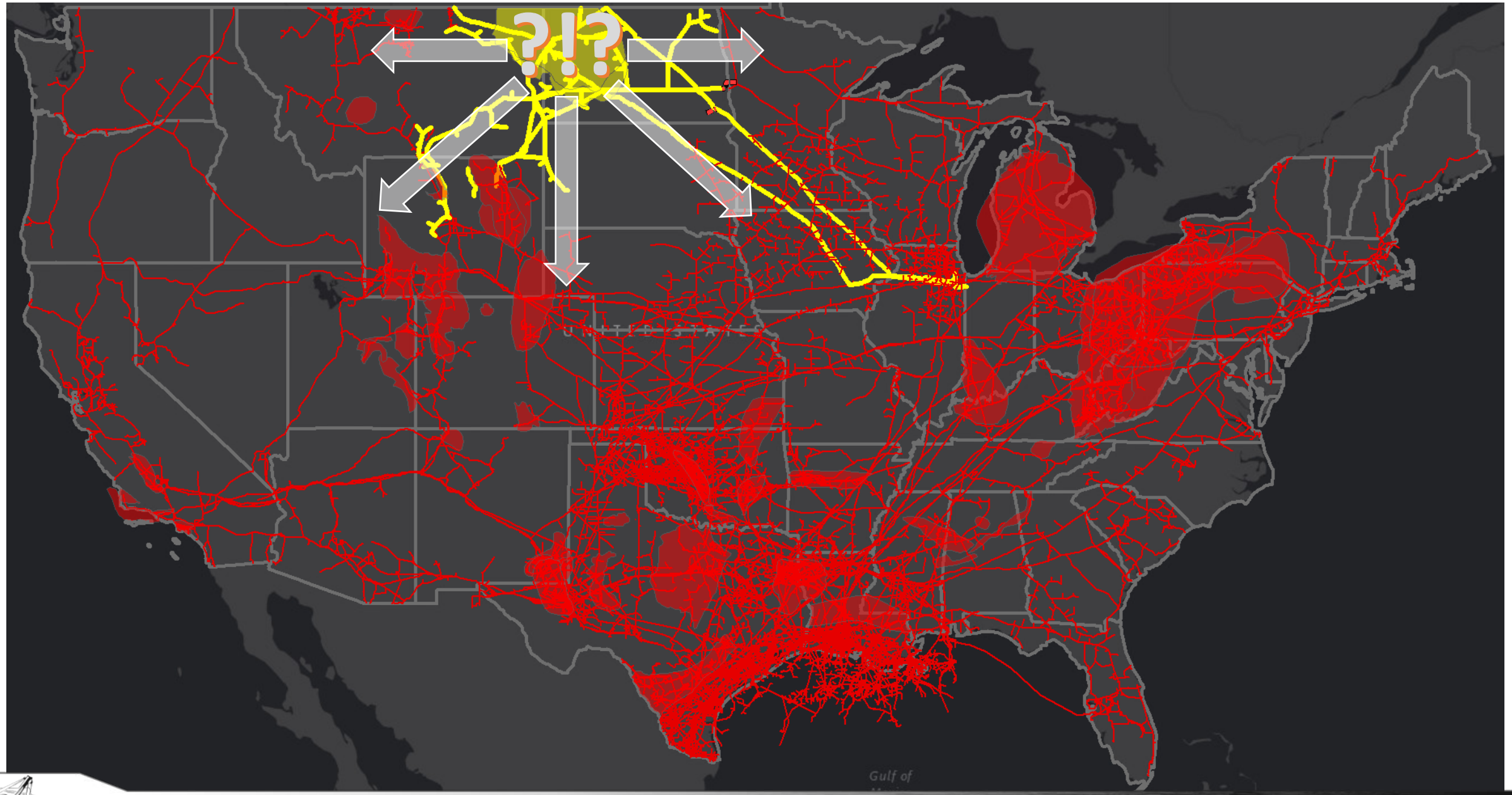
Simplified Example NB Calculations

Conclusion: **IF** no other gas export options open and all other deliveries on other pipelines stay static, ND gas production could increase 1.38-1.68 BCFD (from June-18) before Northern Border is 100% Bakken production. ***BTU management becomes increasingly important for Bakken residue gas.***

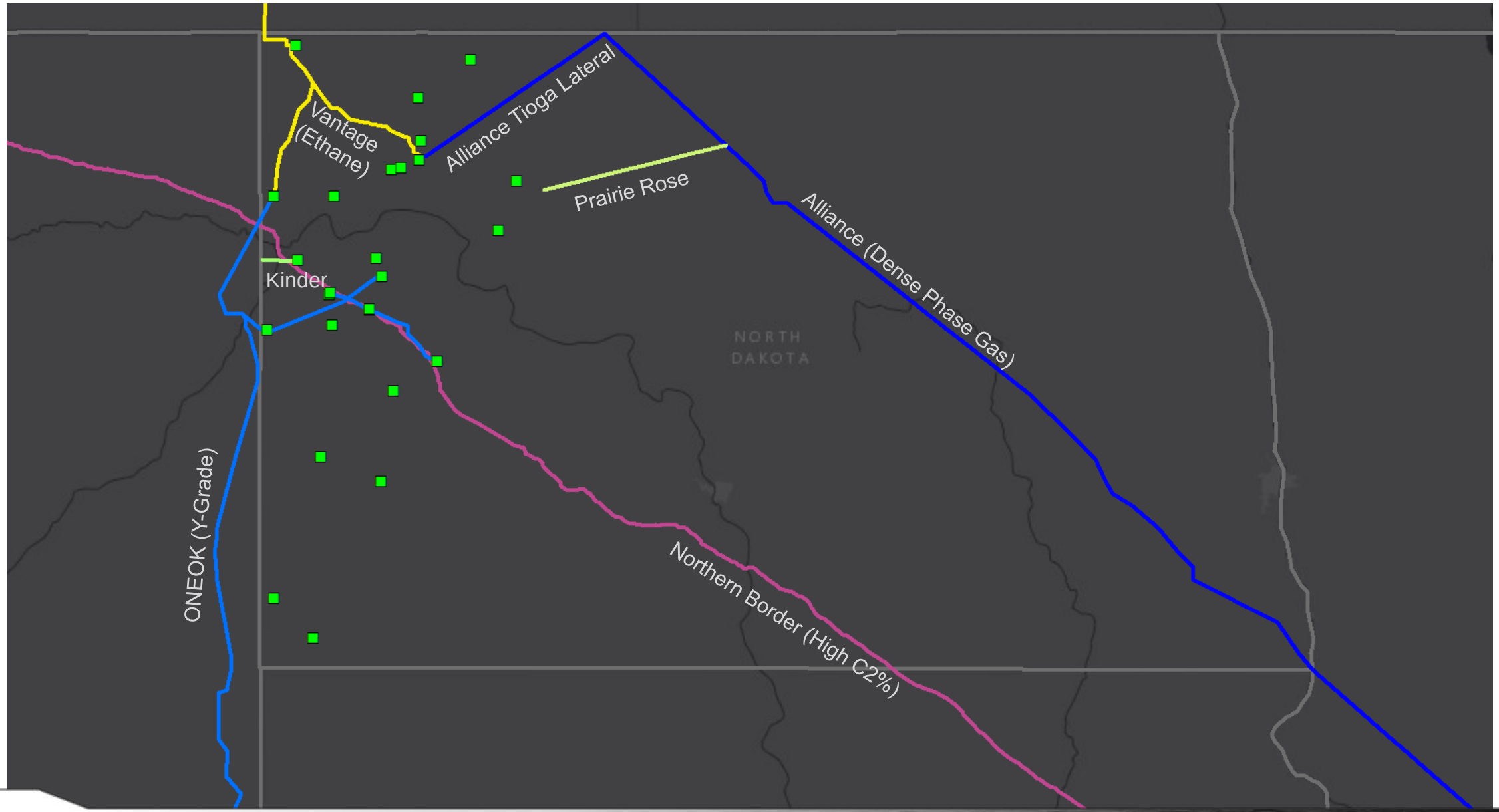
- Gas Plants With C2+ Capture
  ~1,010+ BTU Residue Gas
- Gas Plants With C3+ Capture
  ~1,150+ BTU Residue Gas



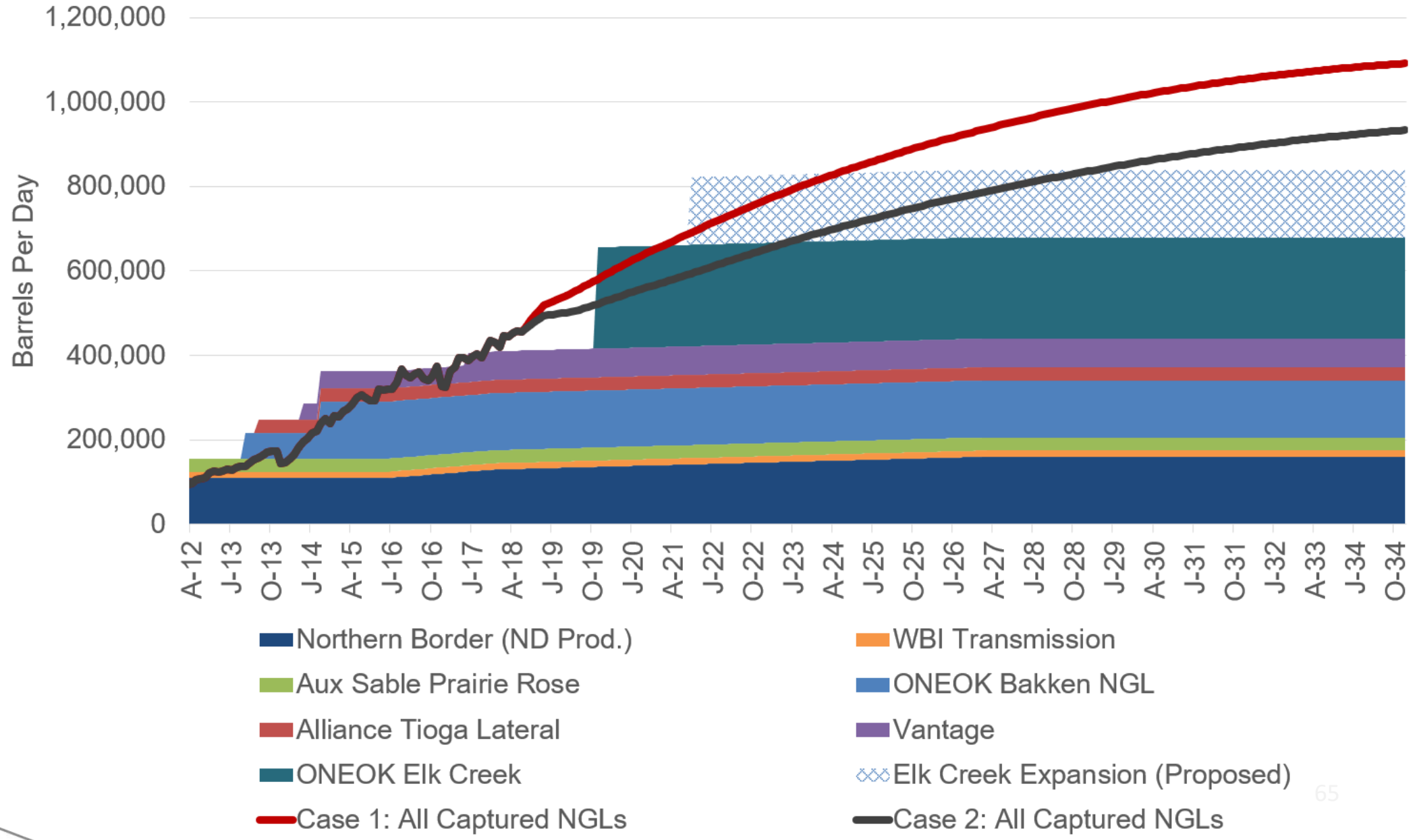
Now What?



Regional NGL Infrastructure



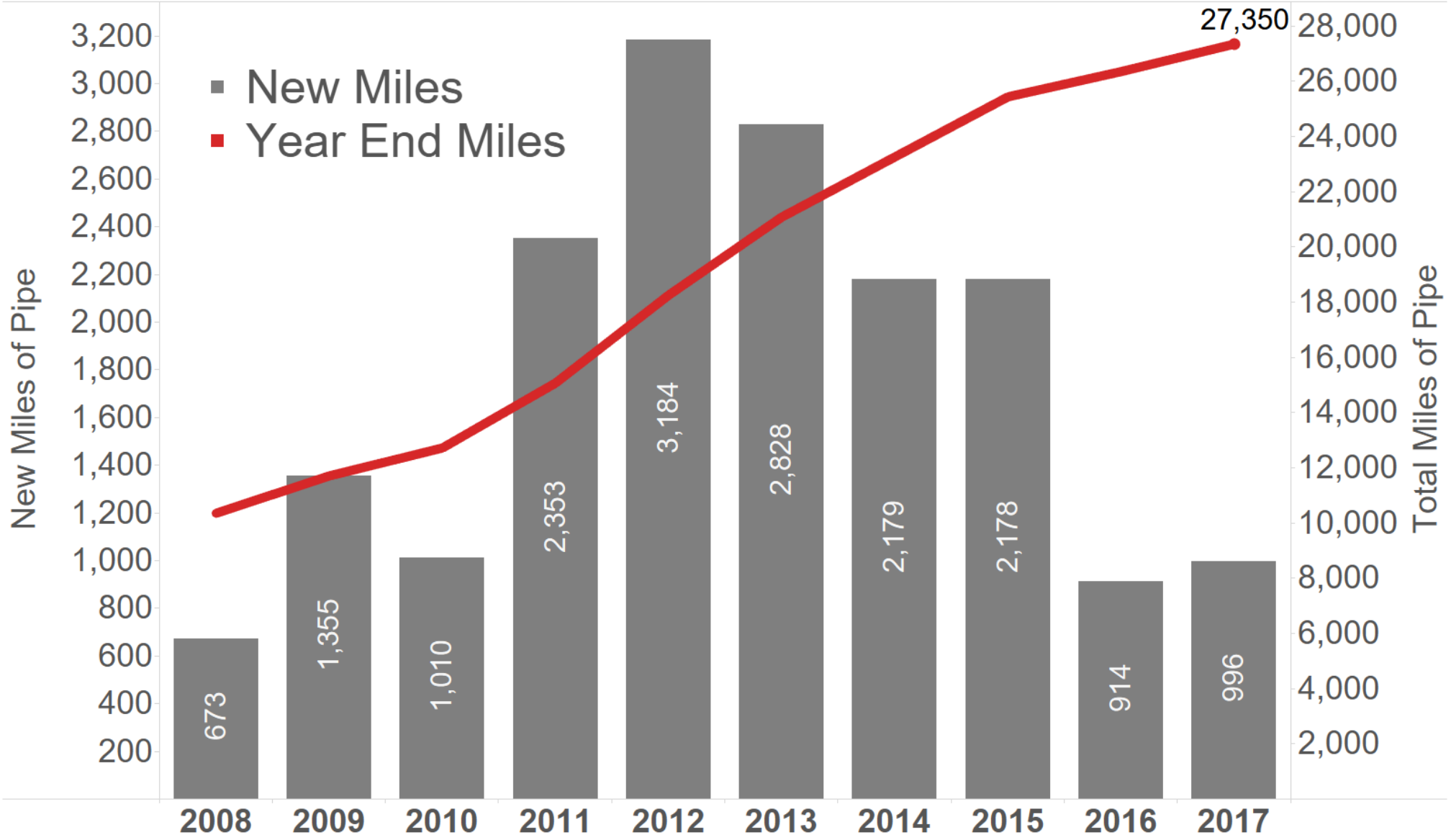
NGL Pipeline Takeaway Options



Presentation Outline

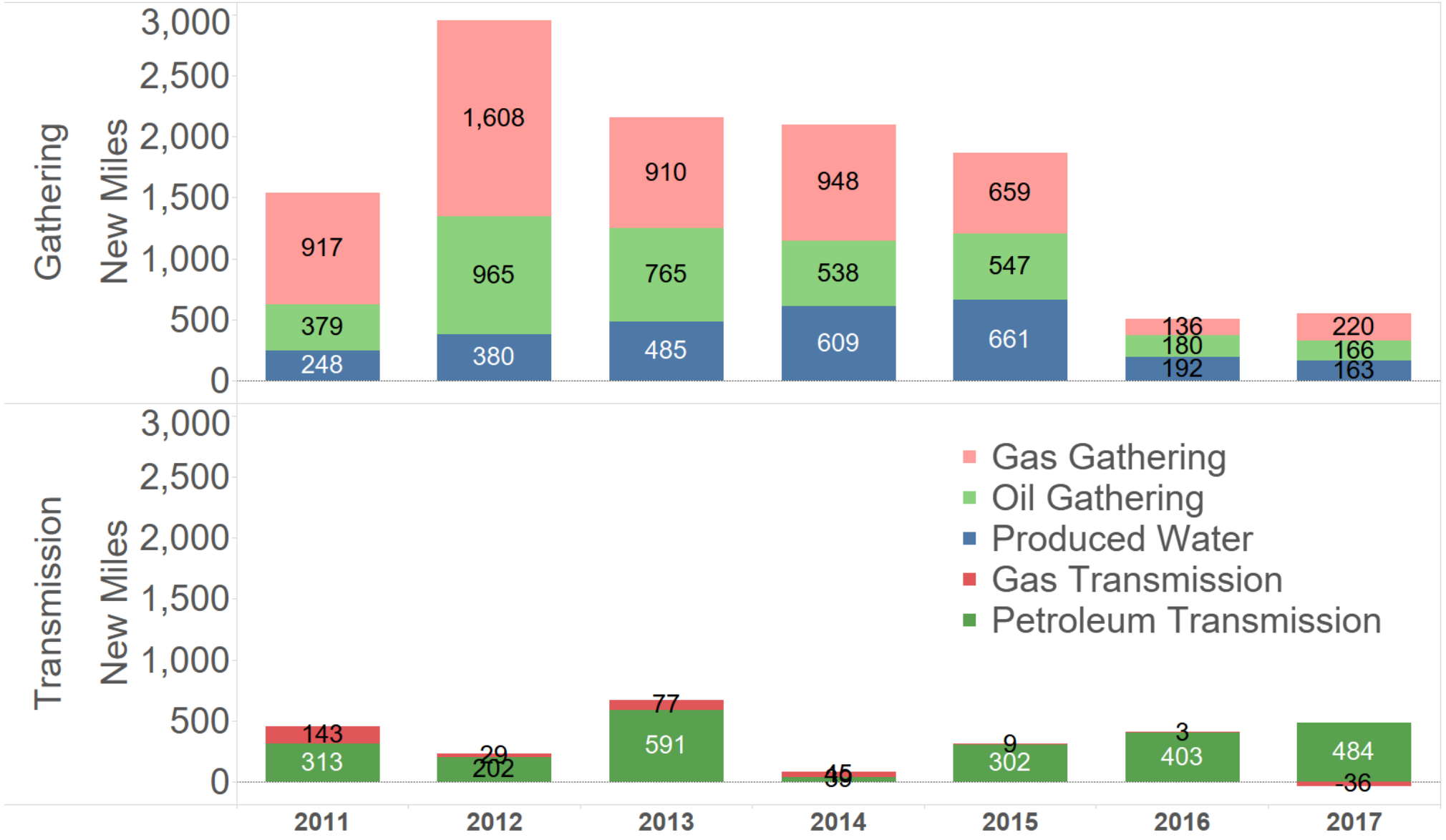
- Economics
- Current Activity and oil transportation dynamics
- Understanding current and future oil production
  - Pricing update
  - Activity
  - Oil forecasts
- North Dakota natural gas production
  - Flaring and gas capture
  - Natural gas liquids
- **Pipeline construction update**

North Dakota Pipeline Construction



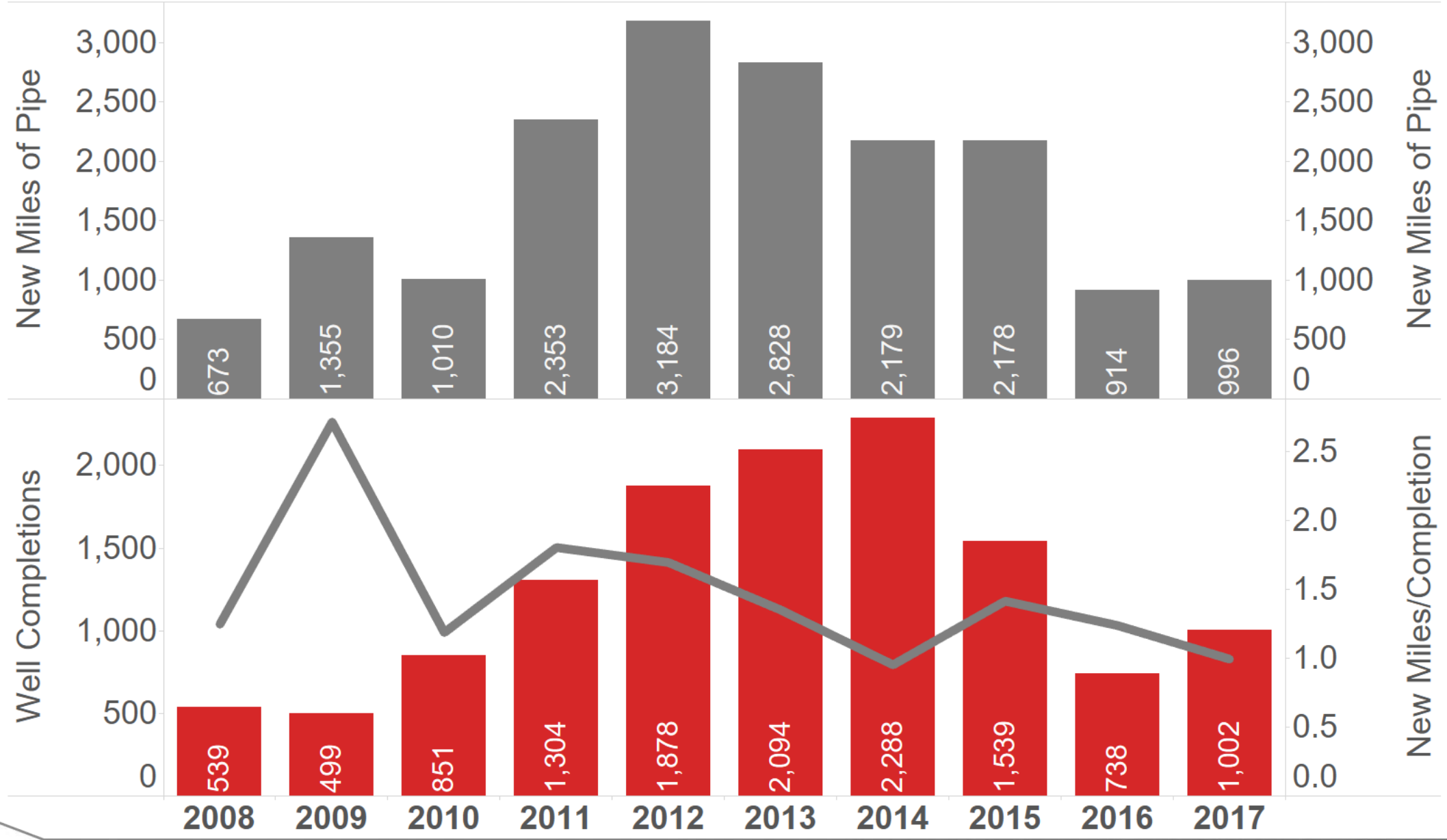
Sources: NDIC & PHMSA

North Dakota Pipeline Construction



Sources: NDIC & PHMSA

New Miles and Well Completions



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

811 Know what's below. Call before you dig.

Websites:

www.pipeline.nd.gov

www.northdakotapipelines.com