

NORTH DAKOTA LAW REVIEW ENERGY LAW SYMPOSIUM

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North Dakota Law Review Energy Law Symposium

Justin J Kringstad

Geological Engineer

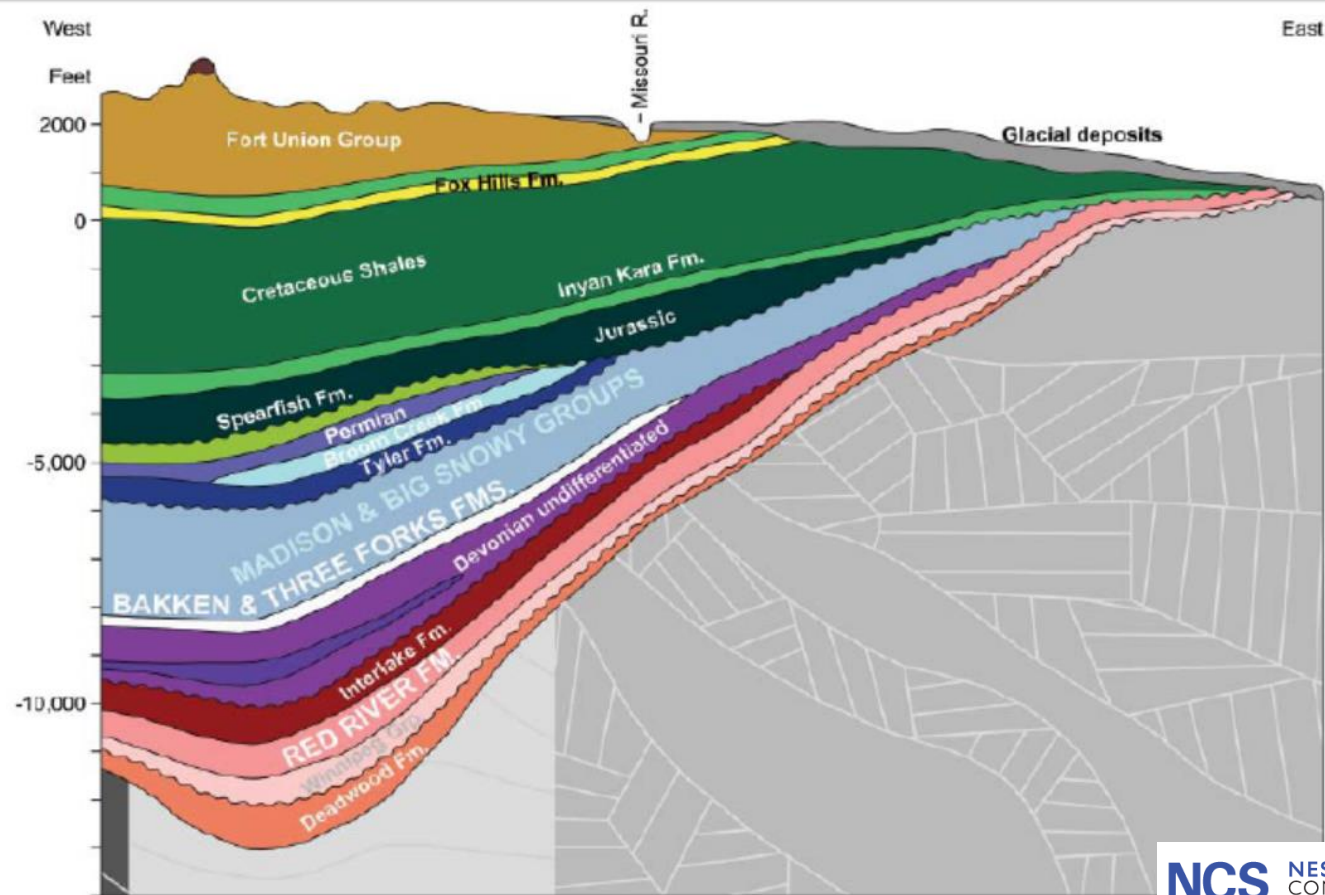
Director

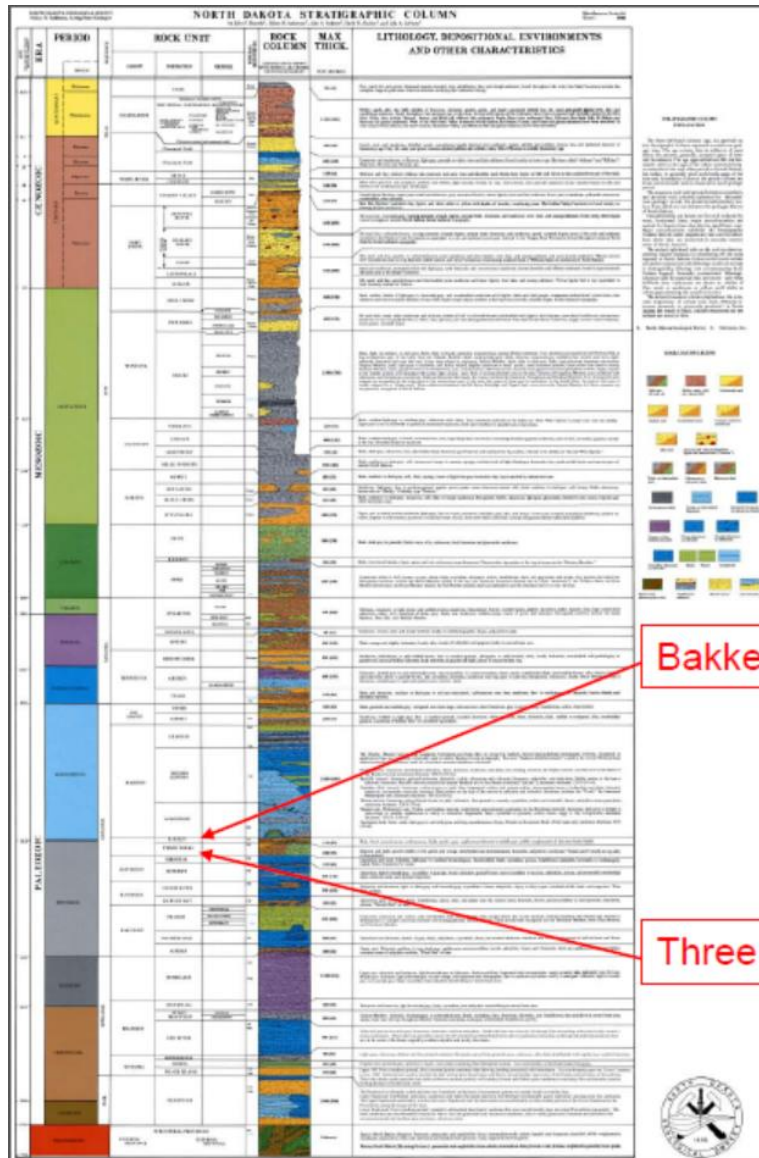
North Dakota Pipeline Authority

April 11, 2019



Williston Basin Deposition





North Dakota Stratigraphic Column

Bakken Formation

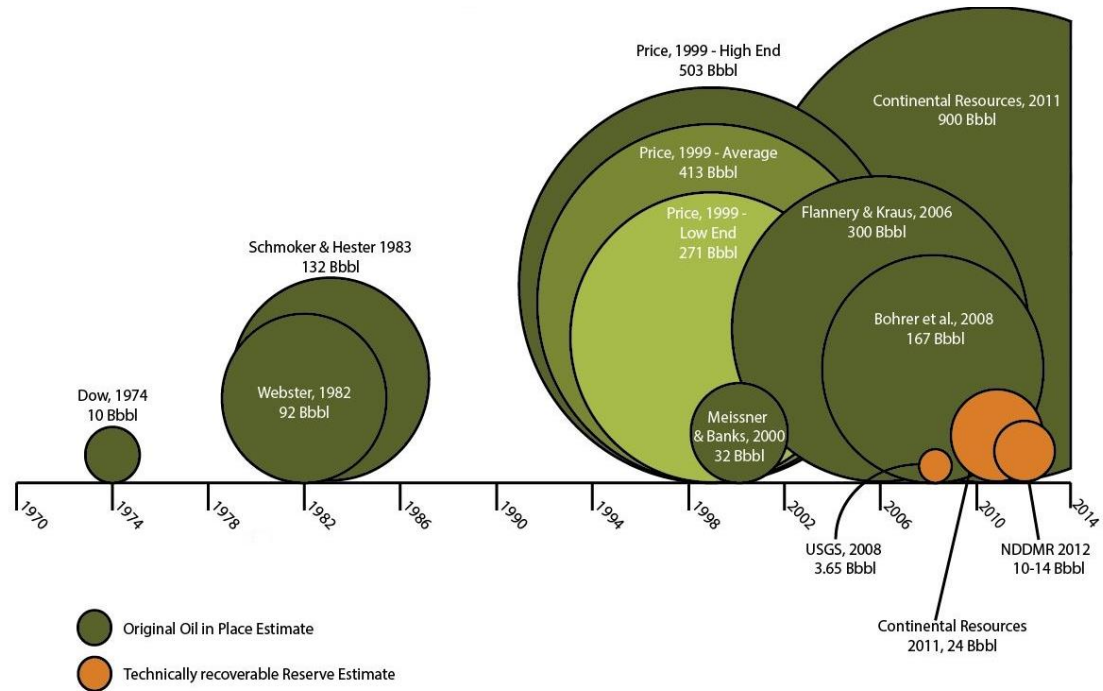
~360 Million Years Old
Paleozoic Era
Mississippian/Devonian Period
~110' thick

Three Forks/Sanish

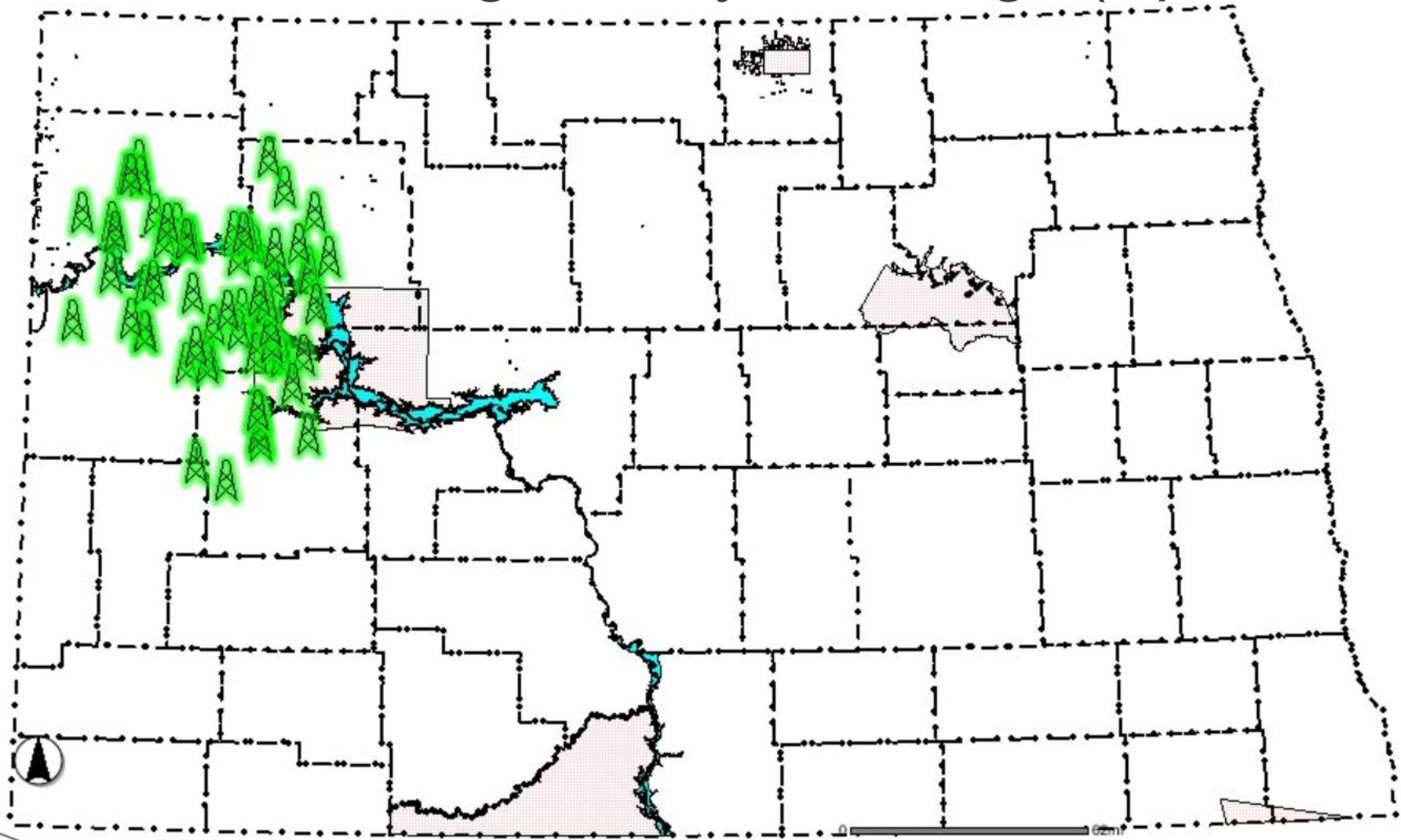
~370 Million Years Old
Paleozoic Era
Devonian Period
~240' thick



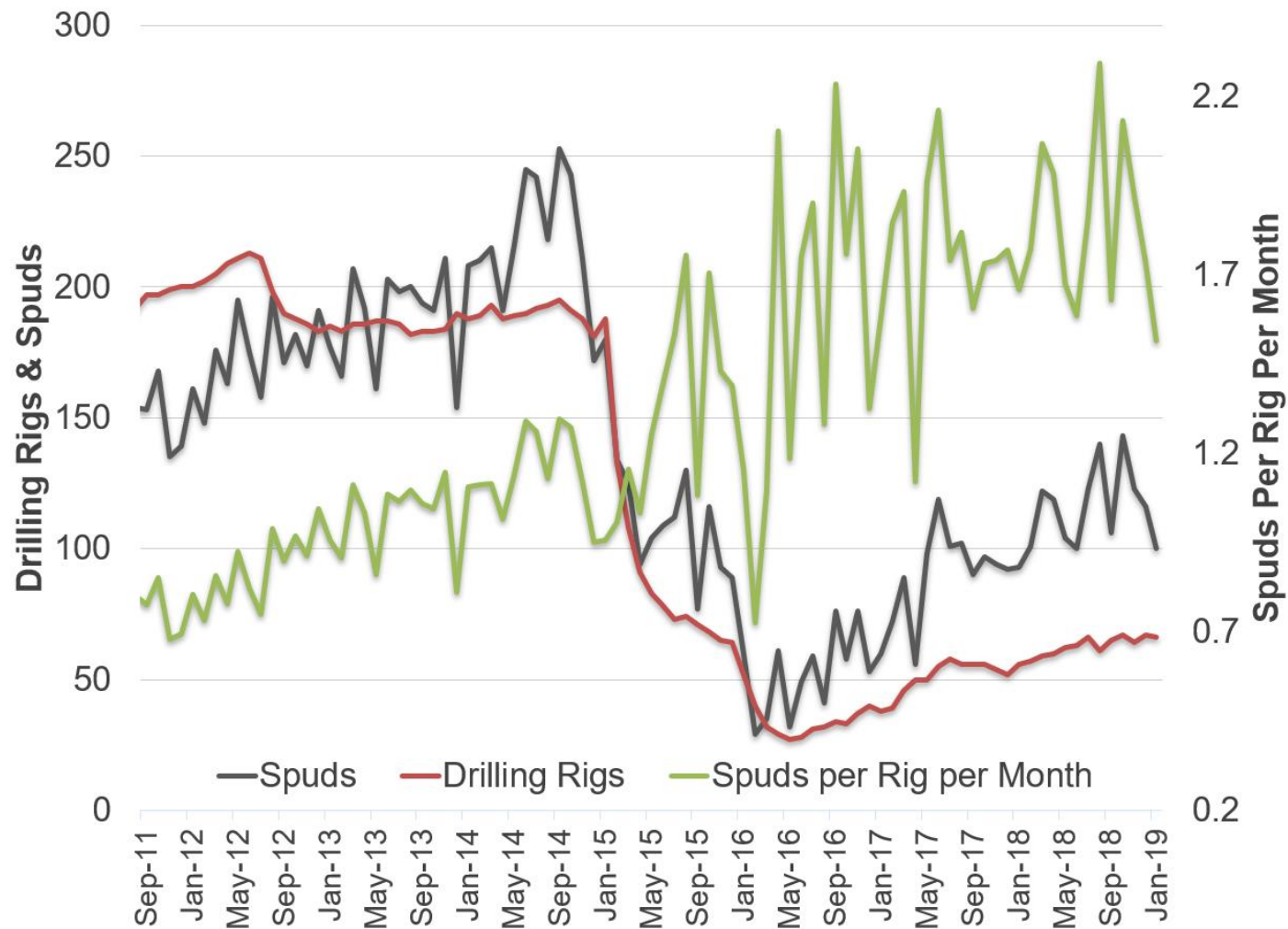
BAKKEN – THREE FORKS FORMATIONS



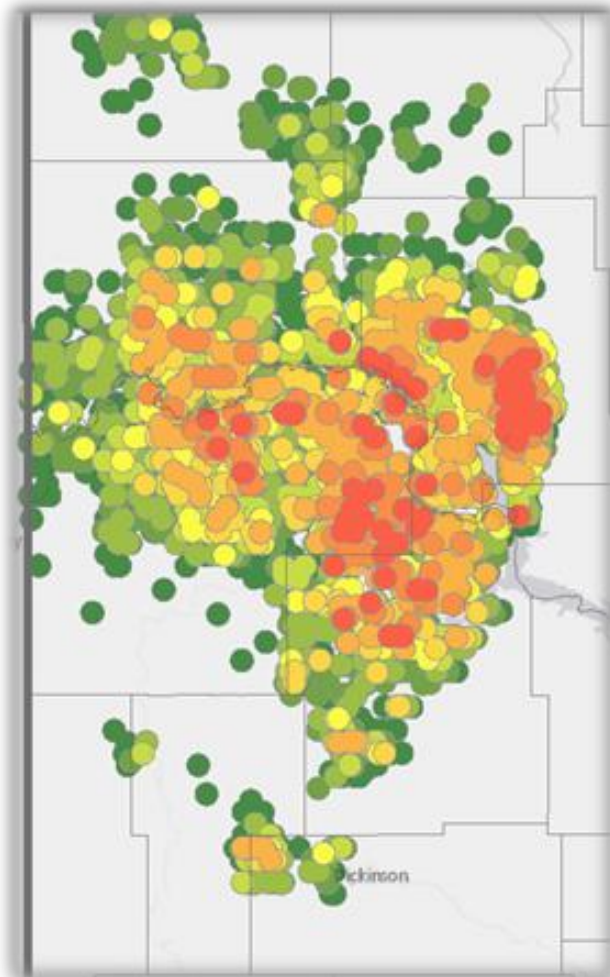
North Dakota Drilling Activity – 63 Rigs (April 9, 2019)



North Dakota Drilling Activity



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, ©
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Bakken-Three Forks Drilling Inventory Study

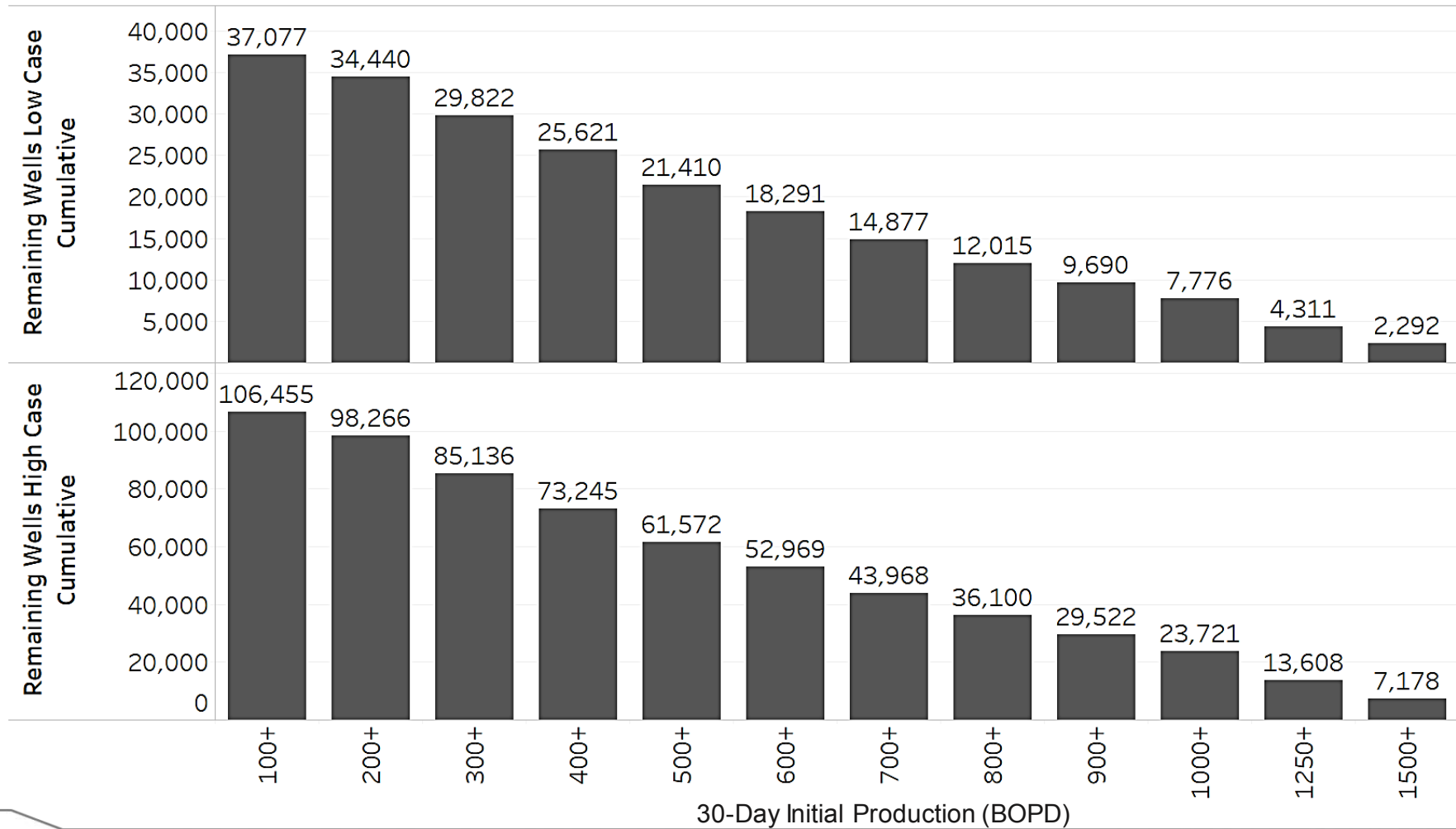


www.northdakotapipelines.com



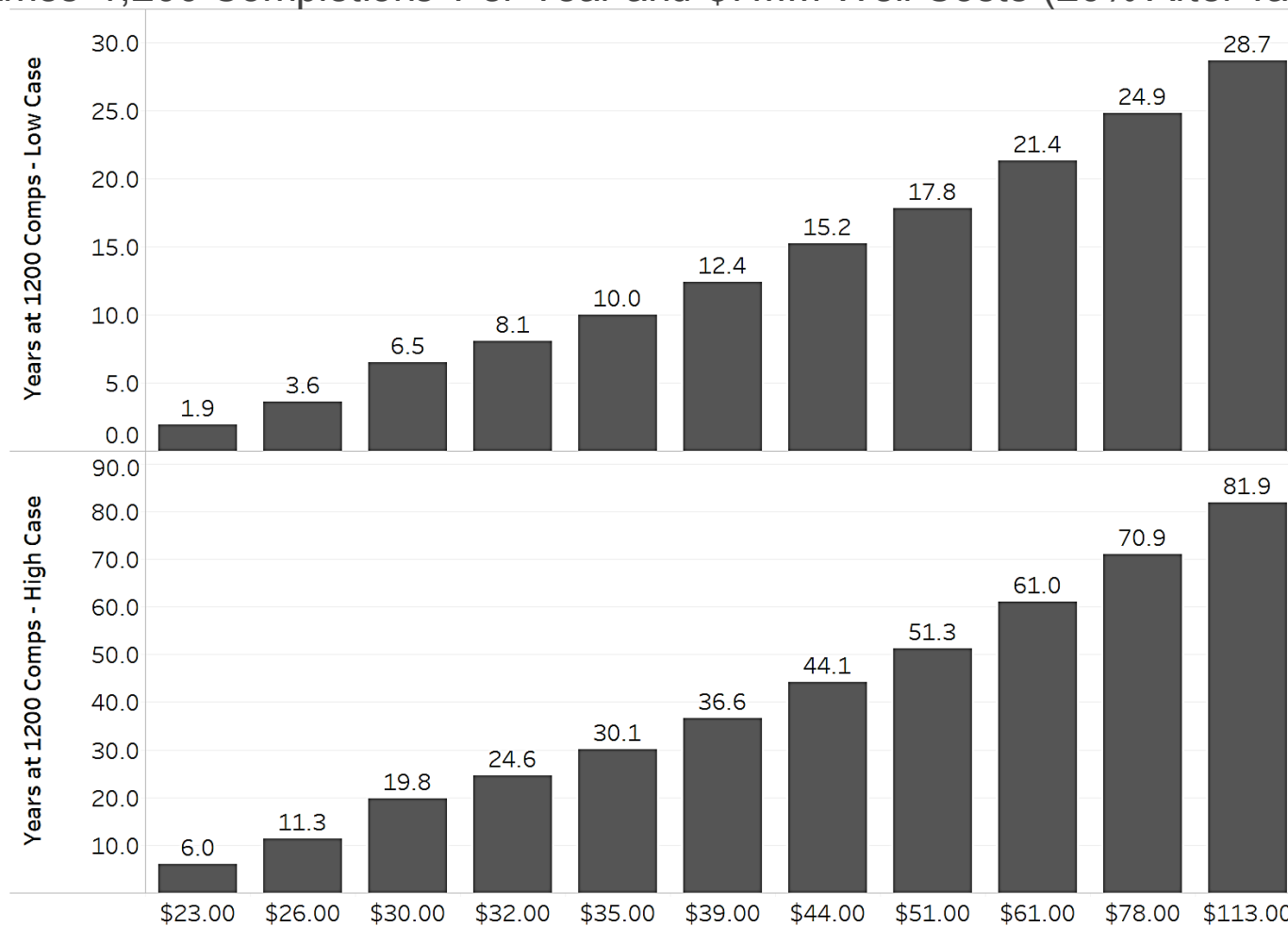
Cumulative Remaining Wells – Peak Month Minimum BOPD

Production Zone

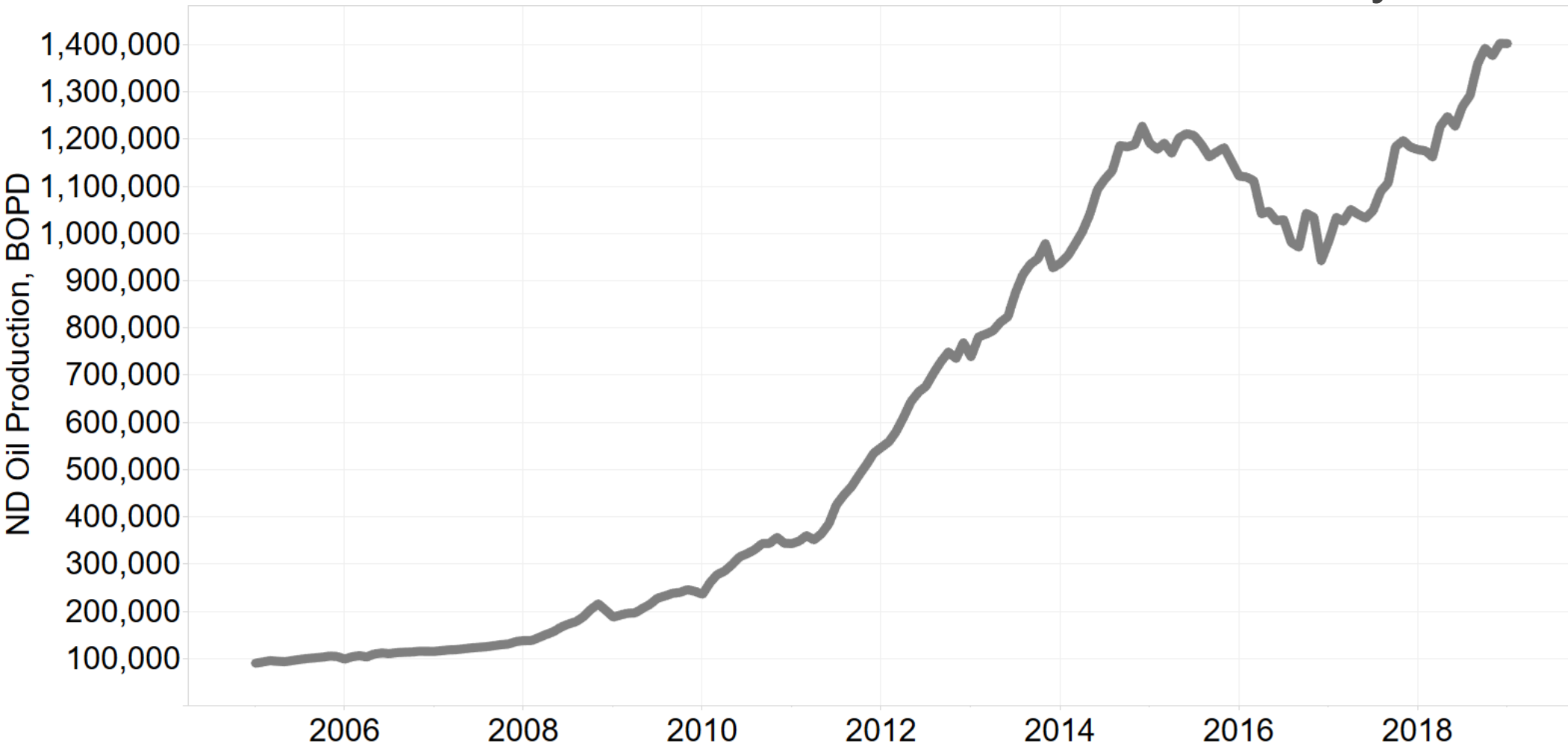


Years Remaining* / Minimum Wellhead Oil Price

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



North Dakota Oil Production – Barrels Per Day





CANADA'S OIL & NATURAL GAS PRODUCERS

For information contact: (403) 267-1141 / CAPP.ca

2017 CANADIAN CRUDE OIL PRODUCTION		
	000 m³/d	000 b/d
British Columbia	12	75
Alberta	534	3,363
Saskatchewan	77	486
Manitoba	6	39
Northwest Territories	0	0.3
Western Canada	630	3,963
Eastern Canada	36	224
Total Canada	665	4,187

COME BY CHANCE
Sleevehead.....130

Harris
Terra Nova

PIPELINE TOLLS FOR LIGHT OIL (US\$ per barrel)	
Edmonton to:	
Burnaby (Trans Mountain)	1.95
Anacortes (Trans Mountain/Puget)	2.25
Sarnia (Enbridge)	4.60
Montreal (Enbridge)	6.10
Chicago (Enbridge)	4.15
Cushing (Enbridge)	5.35*-6.70
Wood River (Enbridge/Mustang/Capwood)	5.90
U.S. Gulf Coast (Enbridge/Seaway)	6.45*-9.55
Hardisty to:	
Guemsey (Express/Platte)	3.30*
Wood River (Express/Platte)	5.05*
Wood River (Keystone)	4.50** 7.95
U.S. Gulf Coast (Enbridge/Seaway)	6.20*-8.65*
U.S. Gulf Coast (Keystone/TC Gulf Coast)	9.70*-10.95
U.S. East Coast to Montreal (Portland/Montreal)	
	0.90
St. James to Wood River (Capline/Capwood)	
	1.35
PIPELINE TOLLS FOR HEAVY OIL (US\$ per barrel)	
Hardisty to:	
Chicago (Enbridge)	4.35
Cushing (Enbridge)	5.55*-6.90
Cushing (Keystone)	6.25** 10.10
Wood River (Enbridge/Mustang/Capwood)	6.15
Wood River (Keystone)	5.15** 9.05
Wood River (Express/Platte)	5.65*
U.S. Gulf Coast (Enbridge/Seaway)	7.30*-10.40
U.S. Gulf Coast (Keystone/TC Gulf Coast)	10.55*-12.45

Notes: (1) Assumed exchange rate = 0.79 US\$ / 1 C\$ (May 2018 average)
(2) Tolls needed to convert 5 cents
(3) Tolls in effect July 1, 2018
* 10-year committed toll
** 25-year committed toll
† First Open Season, 15-year, 50,000+ b/d committed volumes
‡ International Joint Toll

Crude Refining Capacities as at June 1, 2018
(thousand barrels per day)

PADD Petroleum Administration for Defense District

Major Existing Crude Oil Pipelines Carrying Canadian Crude Oil

Selected Other Crude Oil Pipelines

VANCOUVER TO:
Japan - 4,300 miles
Taiwan - 5,600 miles
S. Korea - 4,600 miles
China - 5,100 miles

VANCOUVER
Parkland Fuel (Burnaby).....55

PUGET SOUND
BP (Cherry Point).....236
Shell (Anacortes).....137
Anderson (Anacortes).....120
Phillips 66 (Ferndale).....105
TrailStone (Tacoma).....42

SAN FRANCISCO
Chevron (Richmond).....257
Anderson (Marina).....166
Shell (Marina).....145
Valero (Genoa).....145
Phillips 66 (Rodeo & Santa Monica).....120

LOS ANGELES
Anderson (Cannon/Wilmington).....380
Chevron (El Segundo).....269
PBF (Torrance).....155
Phillips 66 (Cannon/Wilmington).....139
Valero (Wilmington).....85
Dek (3-Paramount, LA, Bakersfield).....idid

UPGRADERS.....BITUMEN CAPACITY
Suncor (Fort McMurray).....465
Suncor (Fort McMurray).....438
Shell (Sudbury).....240
CNRL (Horizon).....290

EDMONTON
Imperial (Sudbury).....191
Suncor.....142
Shell.....100
NW Refining (Sturgeon County).....79
LLOYDMINSTER
Husky asphalt plant.....29
Husky Upgrader.....82

REGINA
Co-op Refinery-Upgrader.....130
MOOSE JAW
Moose Jaw asphalt plant.....19

GREAT FALLS
Calmex.....25

BILLINGS
CNS (Laramie).....60
Phillips 66.....60

WYOMING
Sincir (Sincir).....85
HollyFrontier (Cheyenne).....52
Sincir (Casper).....25
Par Pacific (Newcastle).....18

SALT LAKE CITY
Anderson.....63
Chevron.....53
HollyFrontier.....45
Big West Oil.....35

DENVER
Suncor (Commerce City).....98

OKLAHOMA
Phillips 66 (Ponca City).....203
HollyFrontier (Tulsa).....125
Valero (Edmond).....85
CVR Refining (Wynnewood).....70

BORGER/MCKEE
Valero (Sunny).....195
WRB (Borger).....146

NEW MEXICO/W. TEXAS
Anderson (El Paso).....135
HollyFrontier (Arlene).....100
Dek (Big Spring).....73
Anderson (Gallop).....25

TYLER
Dek.....75

SAN ANTONIO
Calmex.....21

THREE RIVERS
Valero.....89
CORPUS CHRISTI
Fert.....300
Valero.....275
CITGO.....157

HOUSTON/TEXAS CITY
Marathon (Sulveston).....571
ExxonMobil (Baytown).....661
Shell (Over Park).....312
LyondellBasell.....260
Valero (2).....180+225
Petrobras (Pasadena).....110

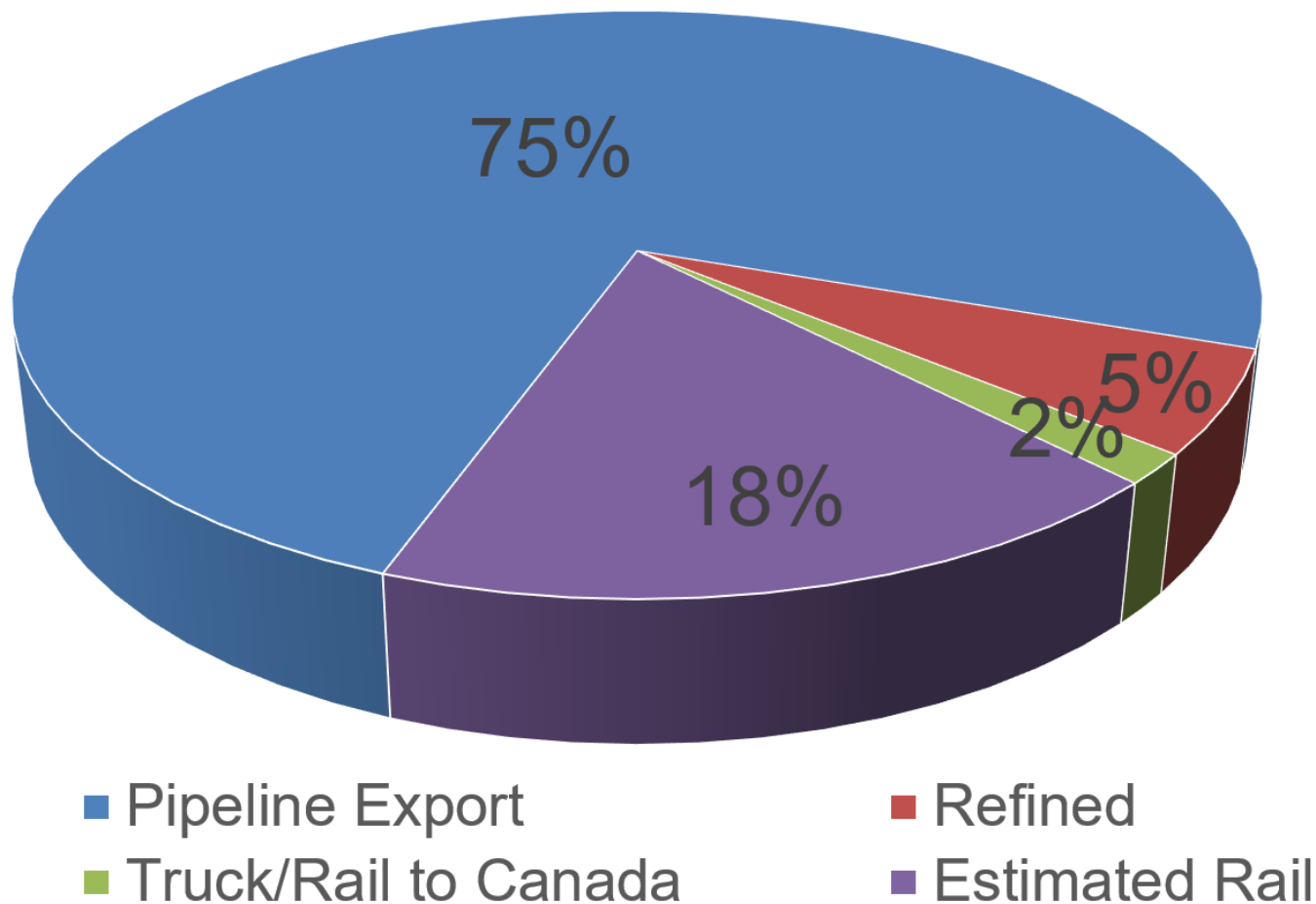
PORT ARTHUR/BEAUMONT
Molten.....570
Valero.....360
ExxonMobil.....335
Total.....228

LAKE CHARLES
CITGO.....425
Phillips 66.....249
Calcasieu.....75

MISSISSIPPI RIVER
Marathon (Garyville).....556
ExxonMobil (Baton Rouge).....503
Phillips 66 (Gulf Channel).....247
Shell (Houma).....229
Shell (Convent).....223
Valero (Houma).....215
PBF (Baton Rouge).....189
Valero (Mer Rouge).....125
Dek (Rice Springs).....74
Pined (Port Allen).....60

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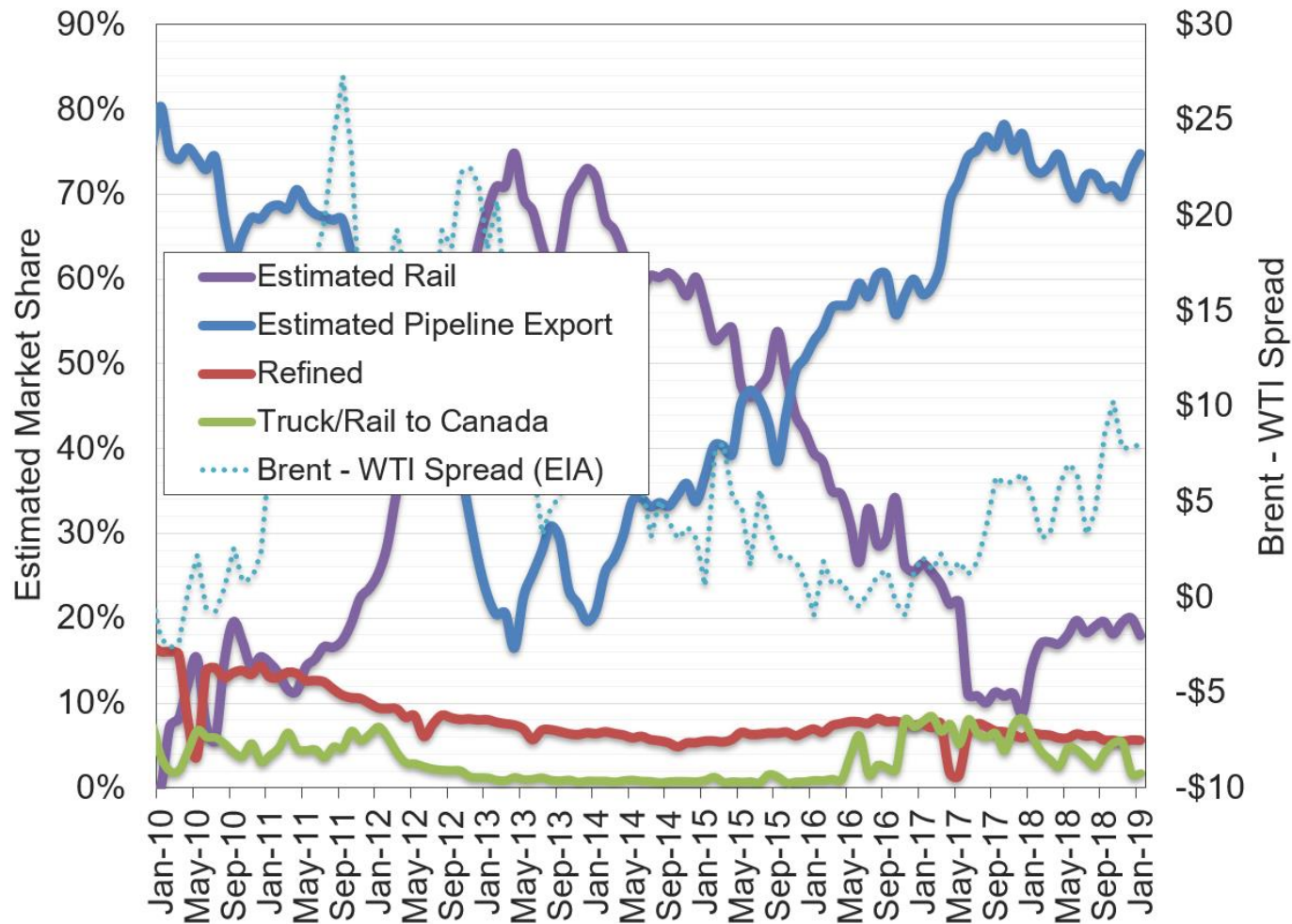
Estimated Williston Basin Oil Transportation – Jan. 2019



128



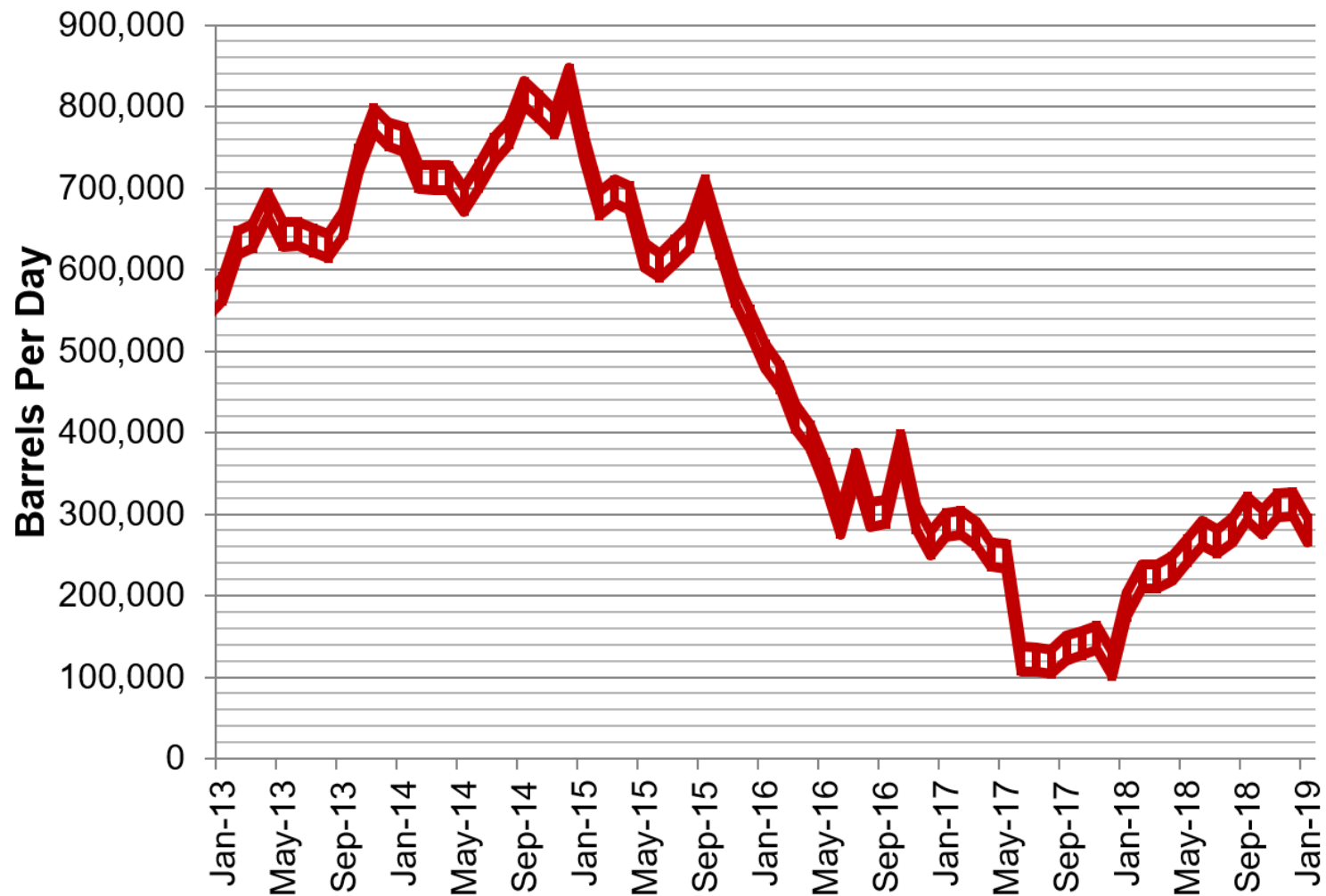
Estimated Williston Basin Oil Transportation



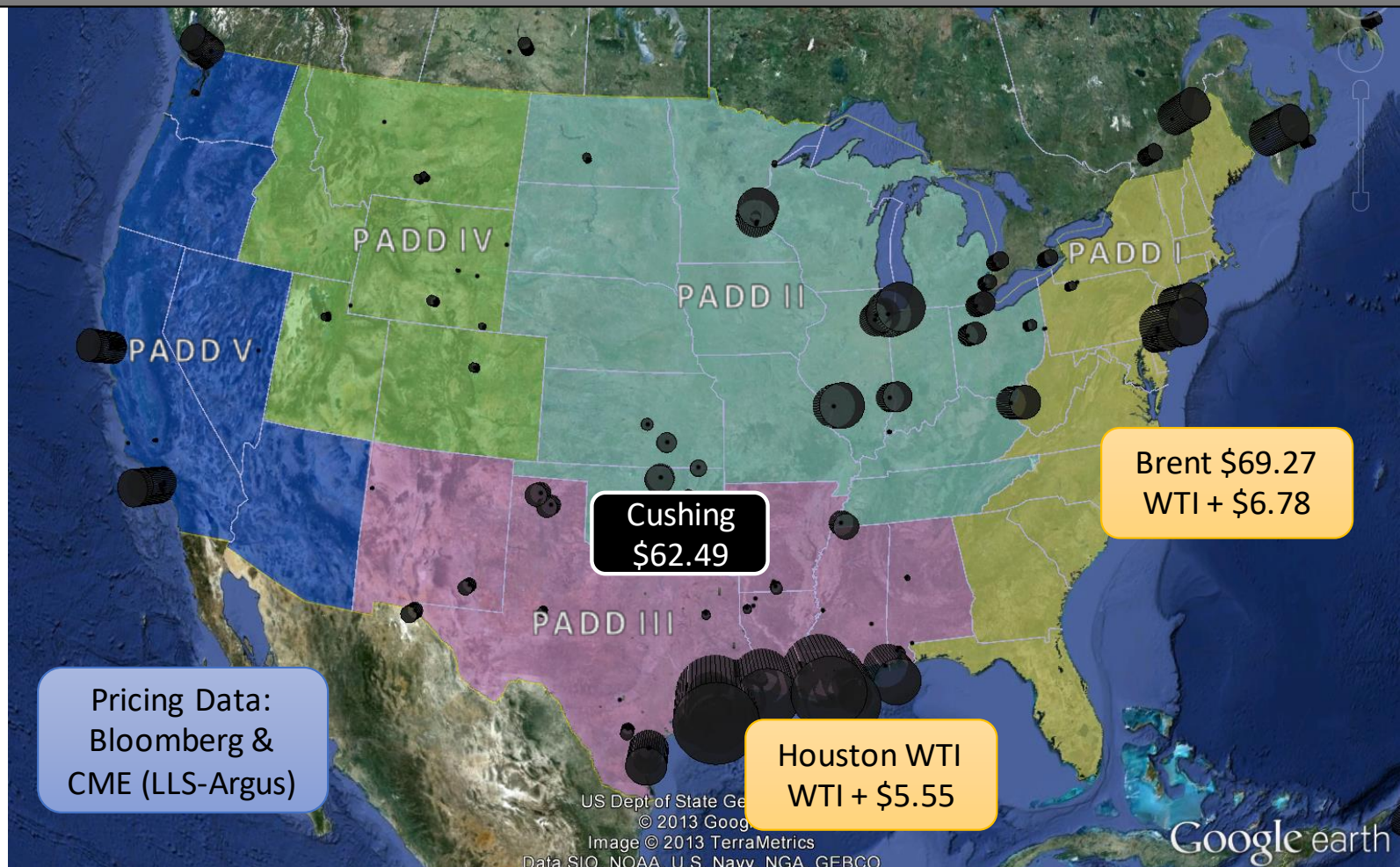
129



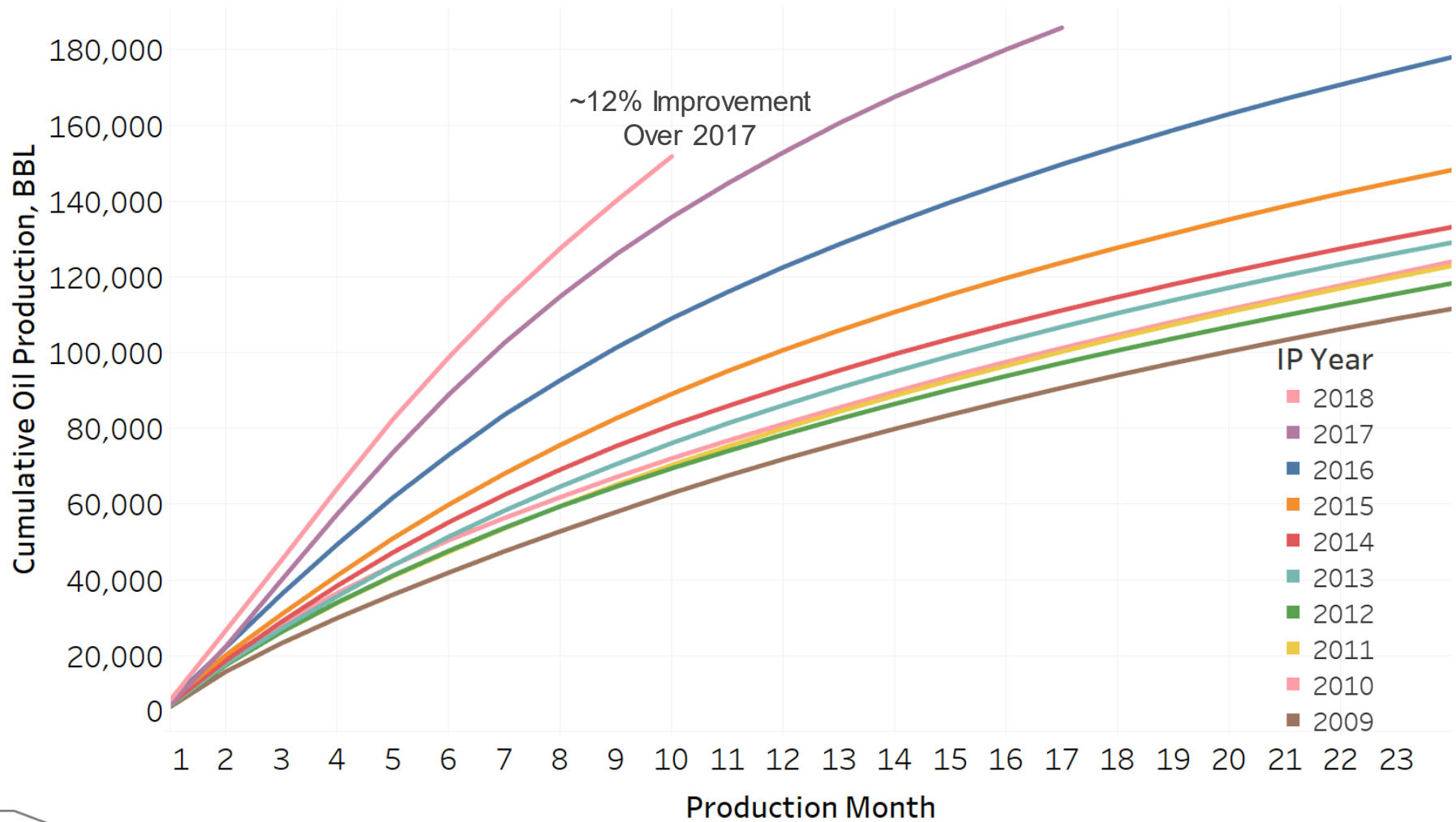
Estimated ND Rail Export Volumes



Crude Oil Prices – April 2, 2019



Statewide Oil Performance



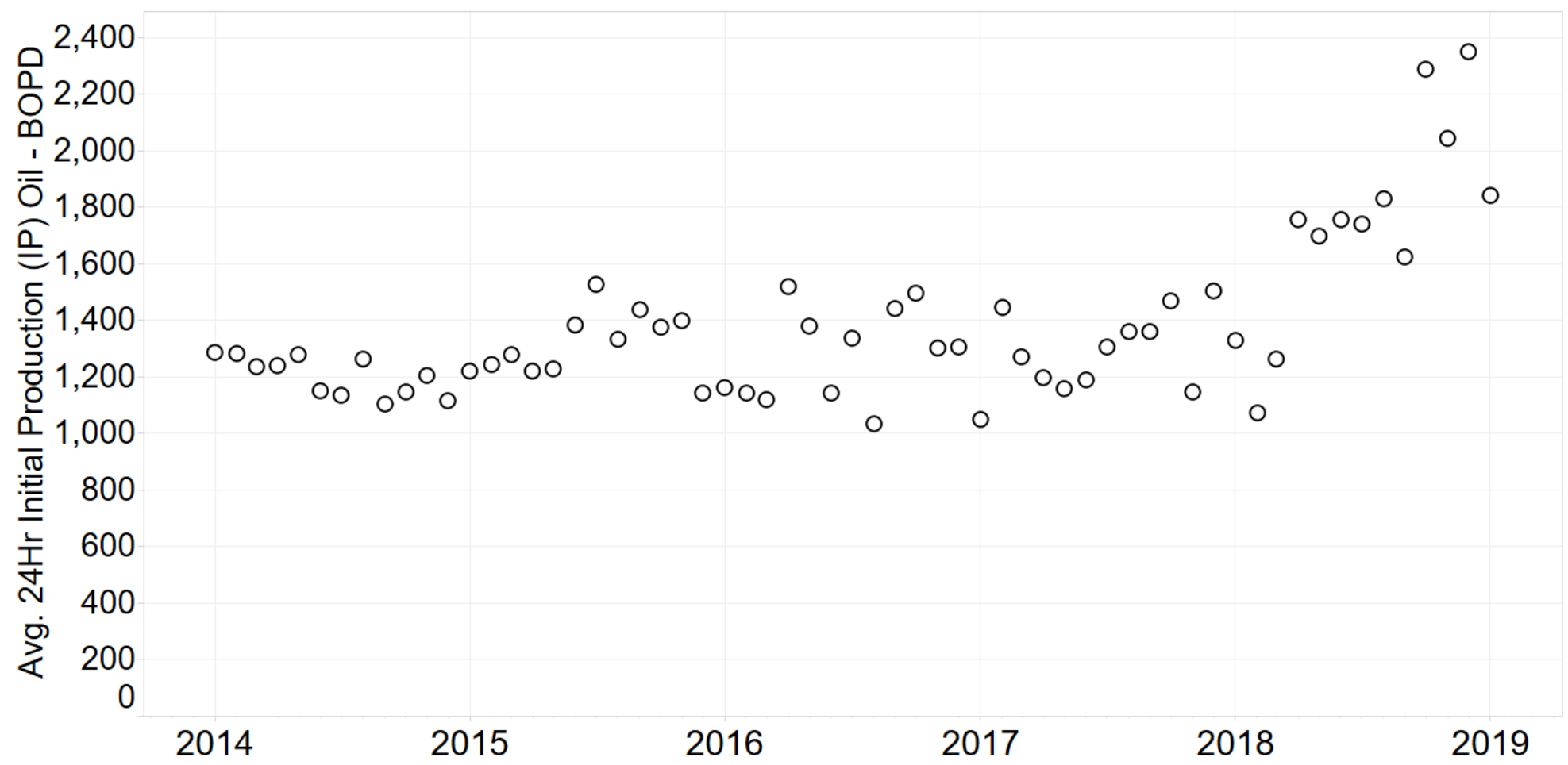
IP Year

- 2018
- 2017
- 2016
- 2015
- 2014
- 2013
- 2012
- 2011
- 2010
- 2009

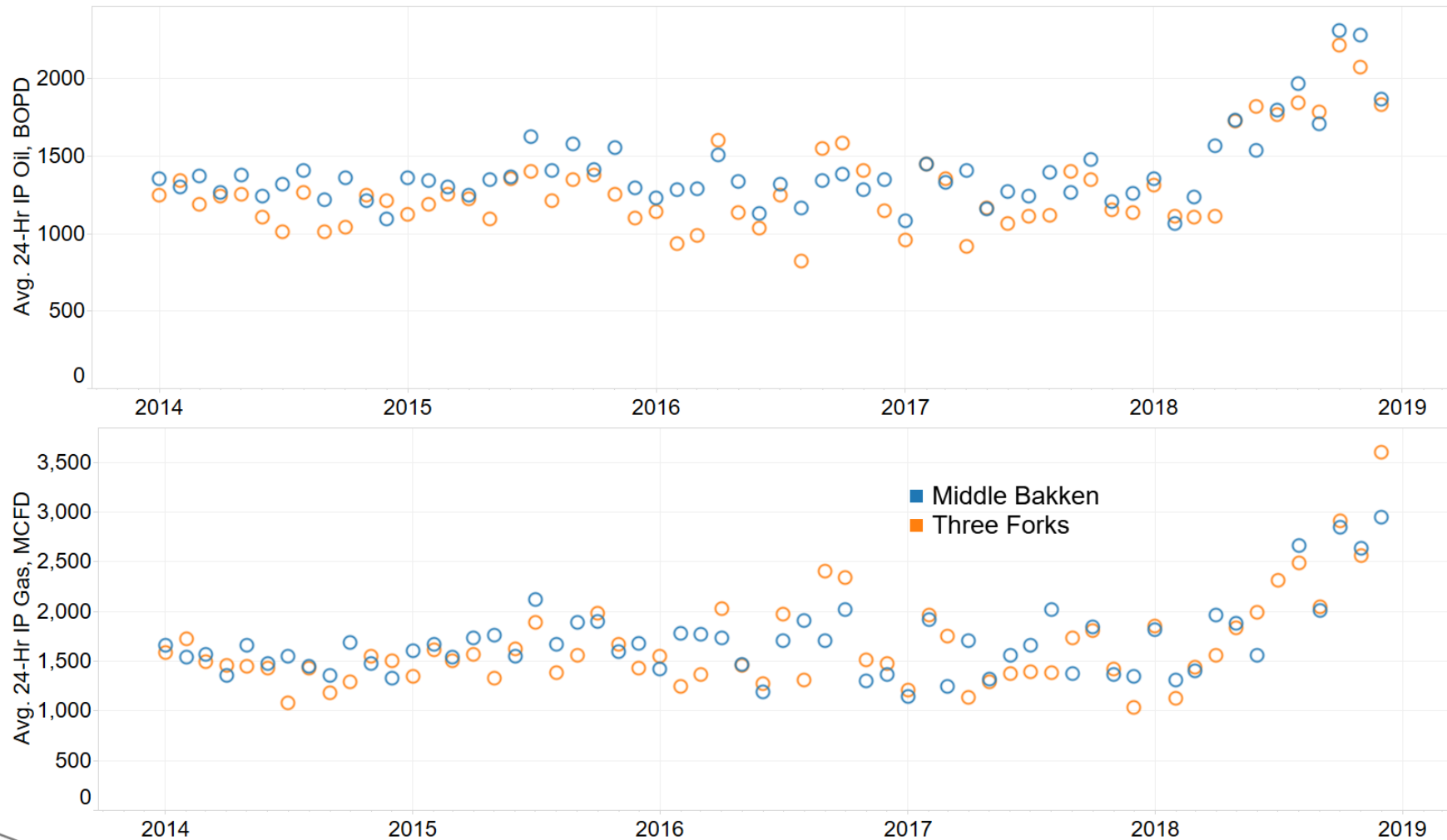
~12% Improvement
Over 2017



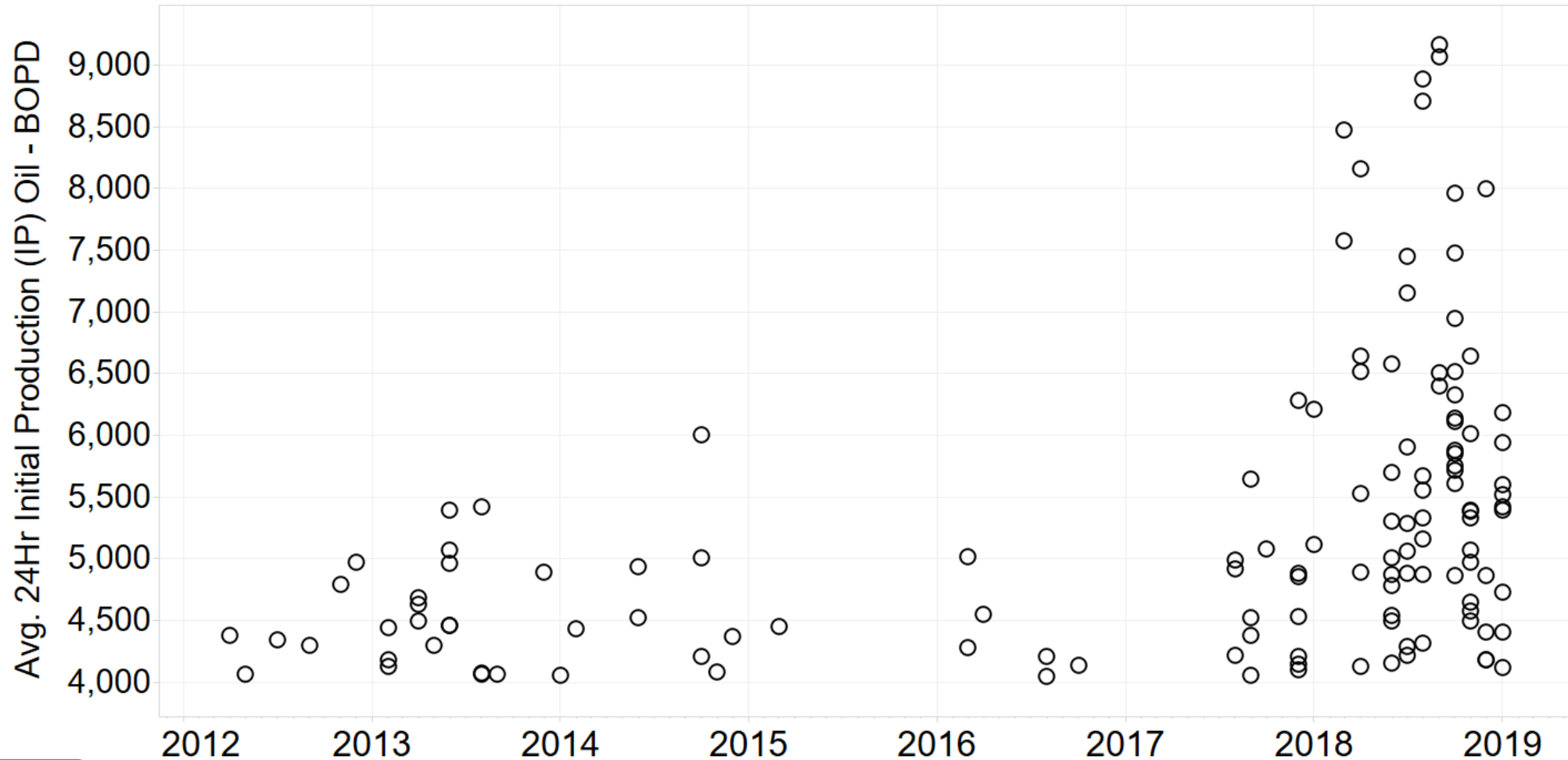
Statewide Initial Oil Production Rates – 24hr



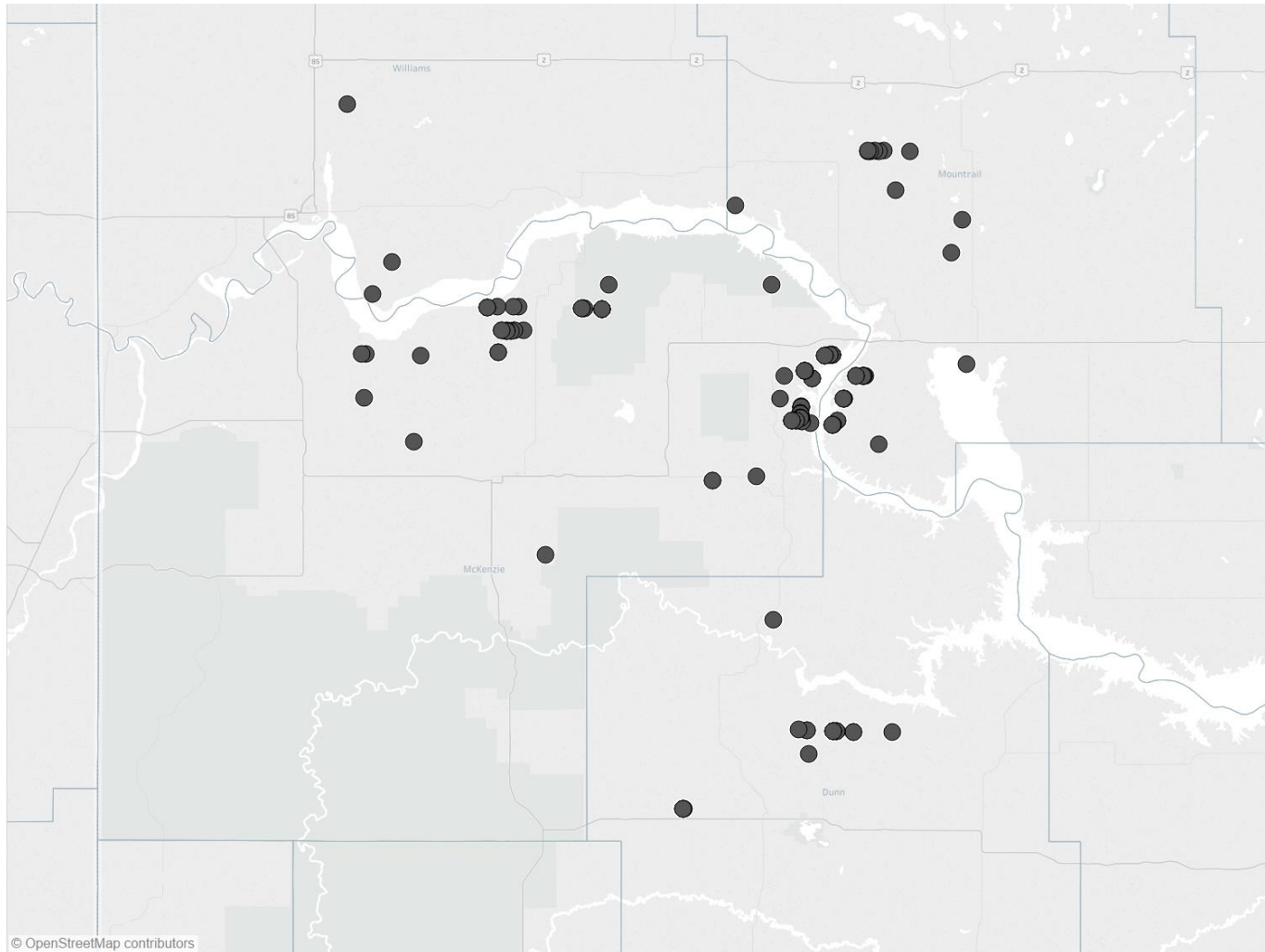
Statewide Initial Production Rate: 24hr



4,000+ BOPD 24hr Initial Production Rates



4,000+ BOPD 24hr Initial Production Rates

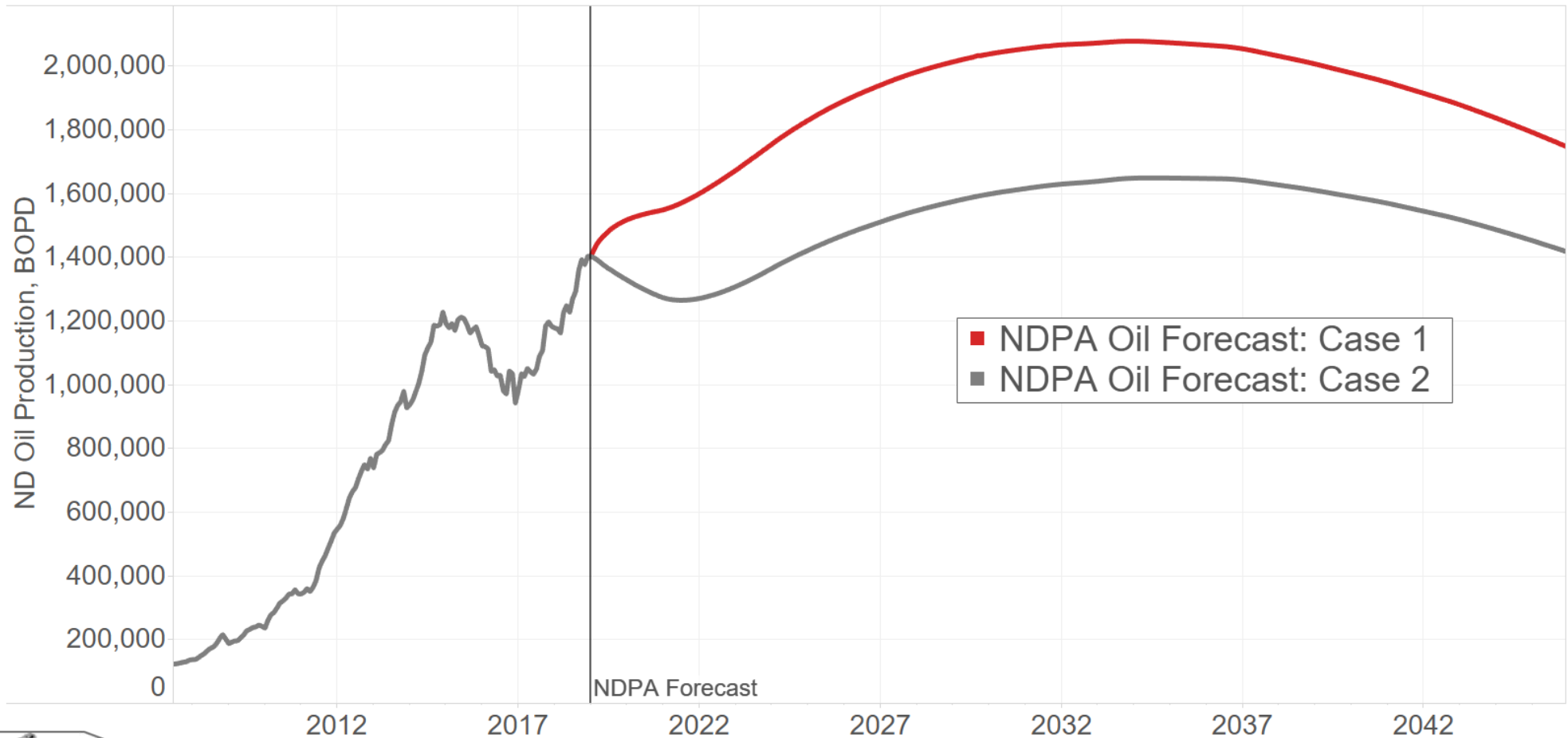


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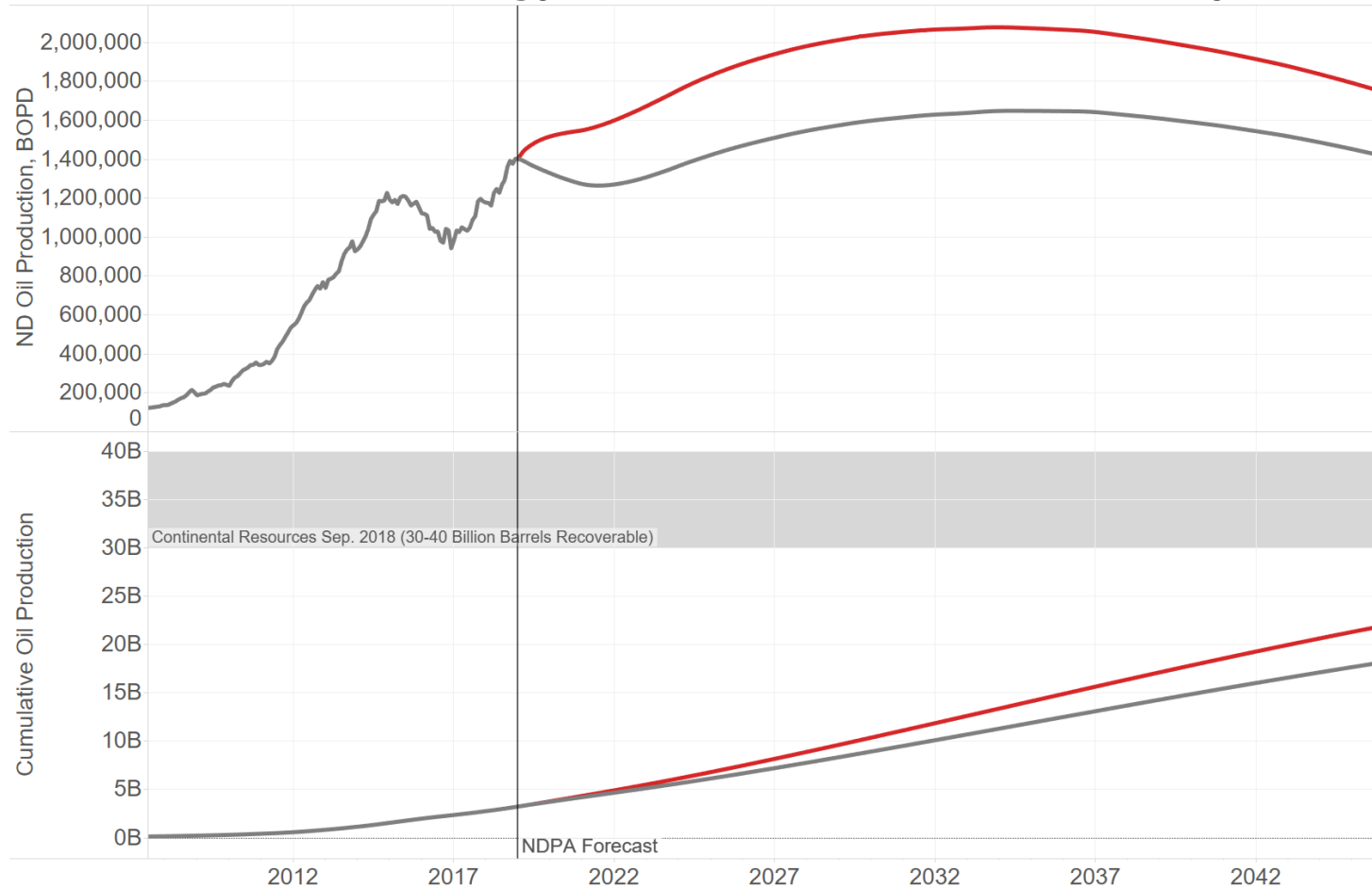
North Dakota Oil Production Forecast

Assumes Current Technology – Enhanced Oil Recovery Not Included

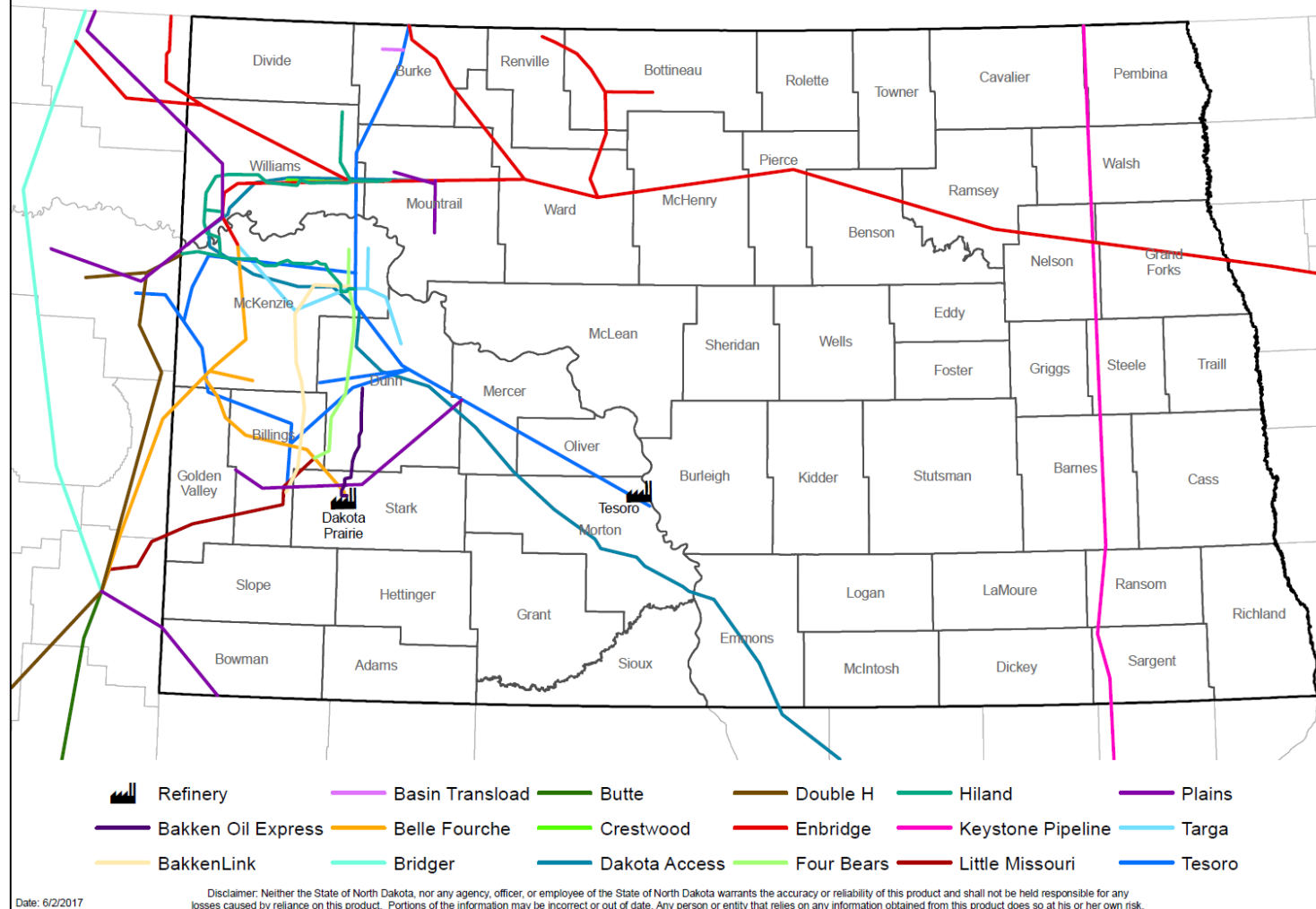


North Dakota Oil Production Forecast

Assumes Current Technology – Enhanced Oil Recovery Not Included

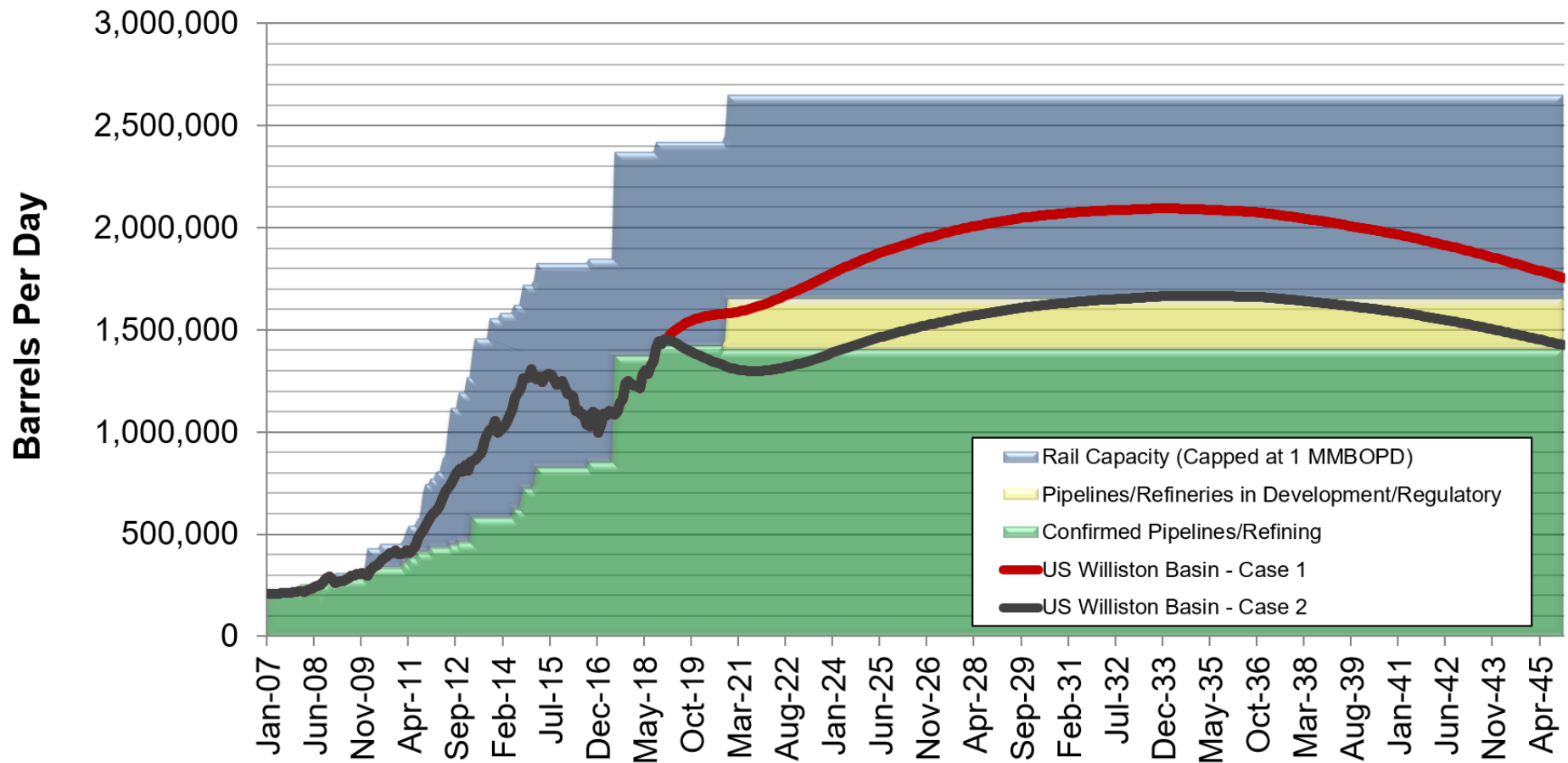


North Dakota Crude Oil Pipelines



Williston Basin Oil Production & Export Capacity, BOPD

Assumes Current Technology – Enhanced Oil Recovery Not Included



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



Natural Gas Update



Production

- Technology
- Markets



Gathering

- Capacity
- Connections



Processing

- Capacity
- Location

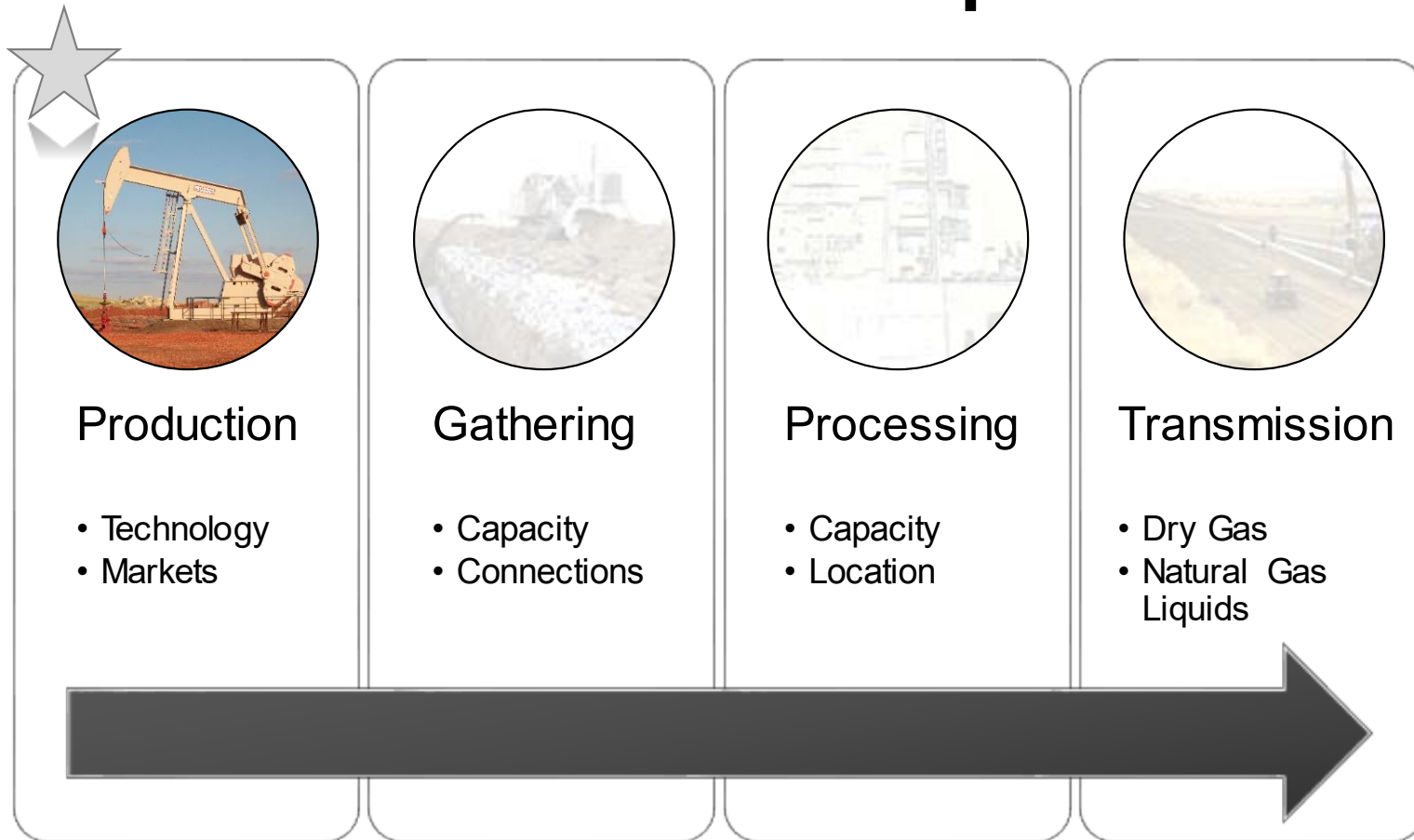


Transmission

- Dry Gas
- Natural Gas Liquids

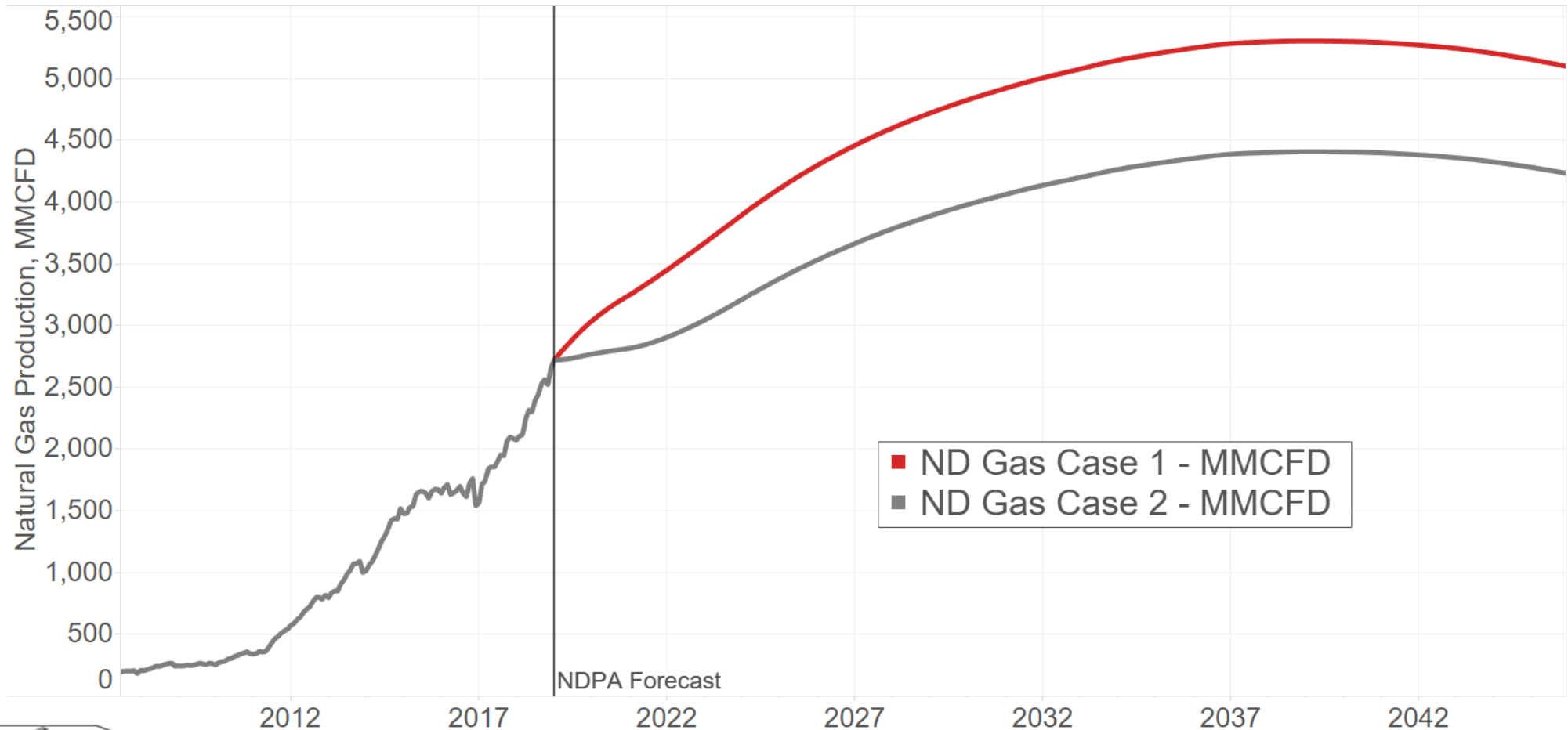


Natural Gas Update

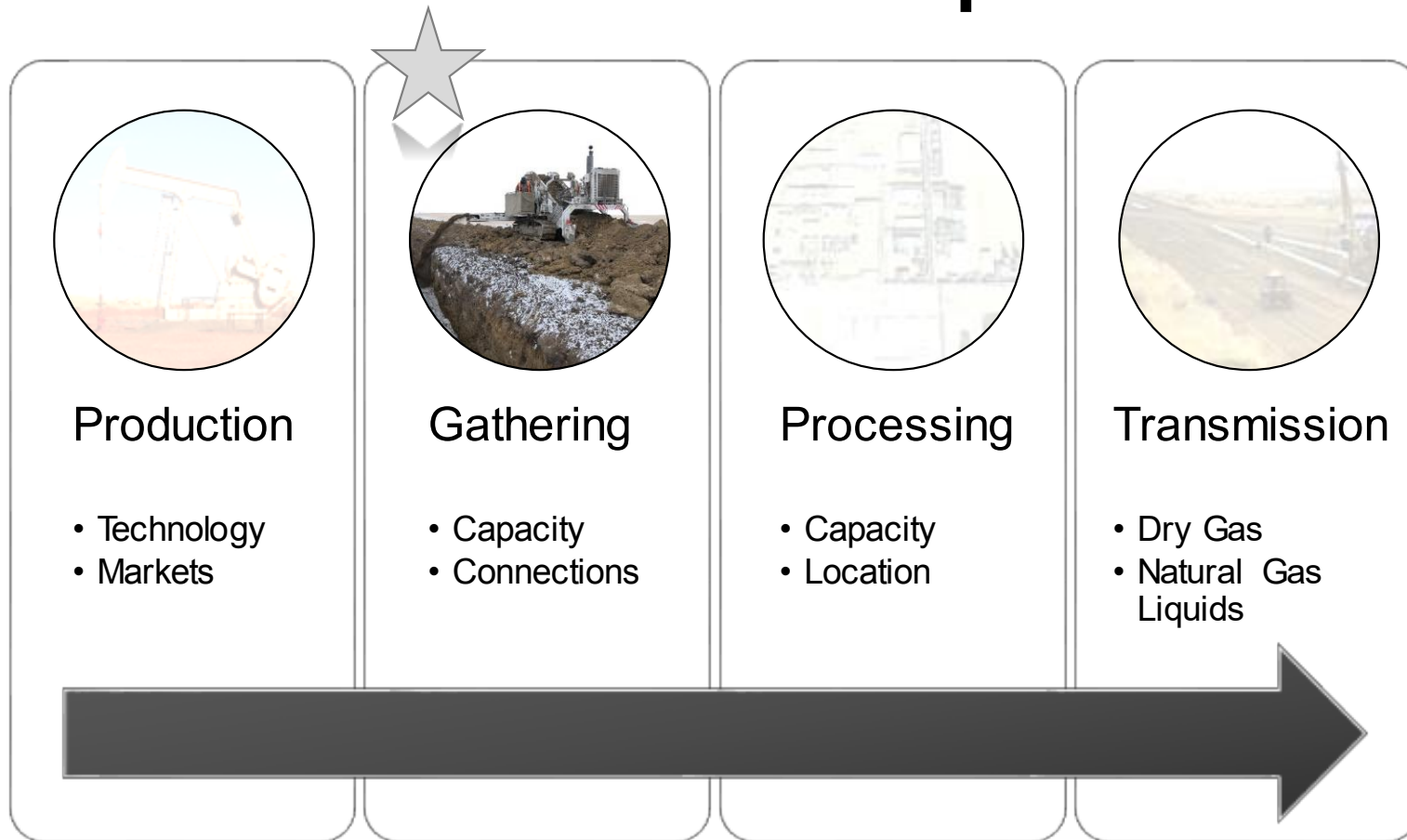


NDPA North Dakota Gas Production Forecast

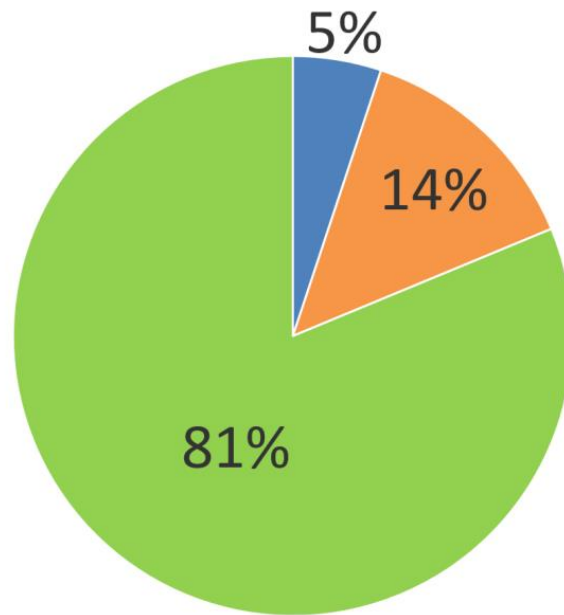
Assumes Current Technology – Enhanced Oil Recovery Not Included



Natural Gas Update



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.

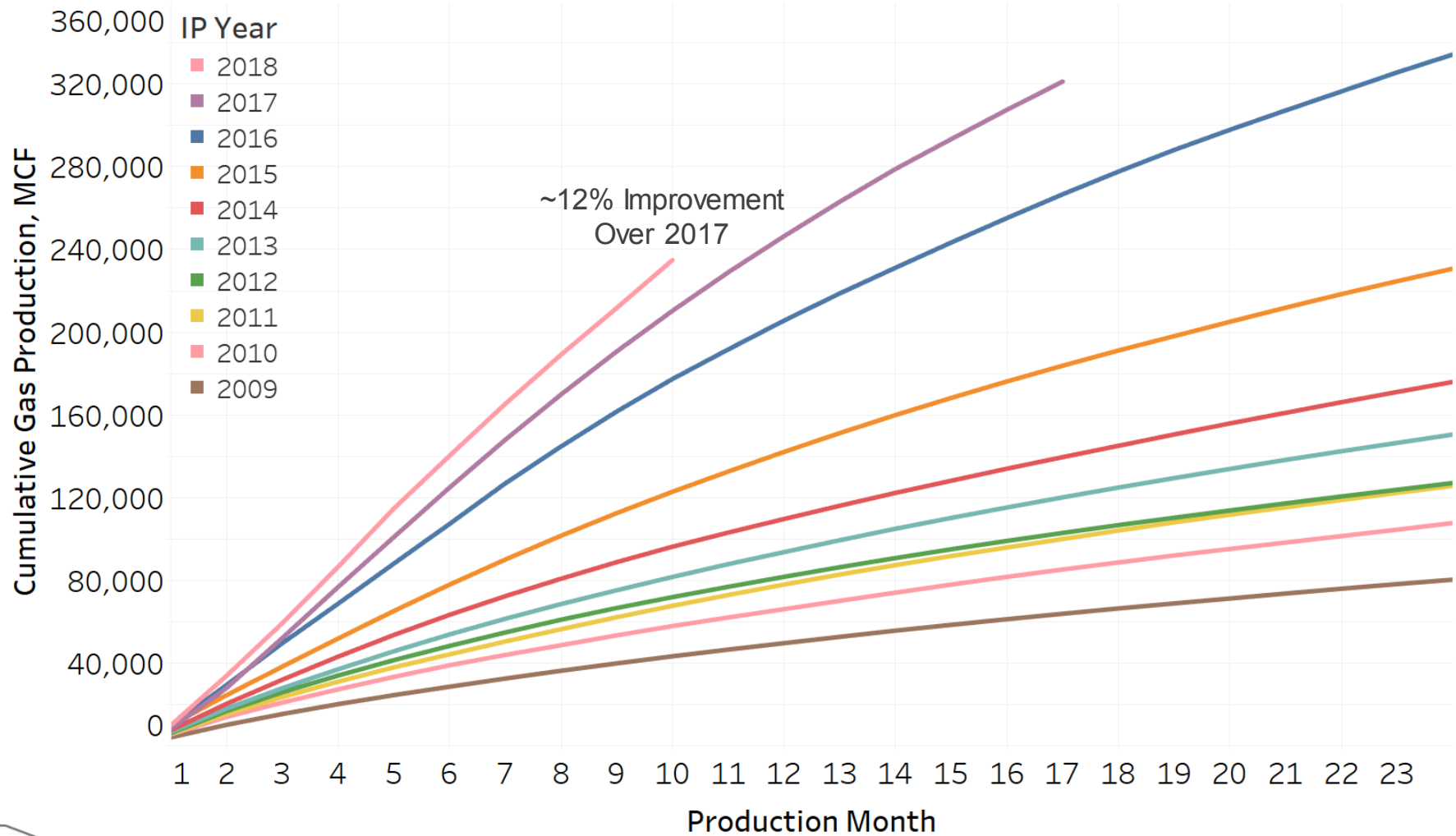
Simple Terms

Blue – Lack of pipelines
Orange – Challenges on existing infrastructure

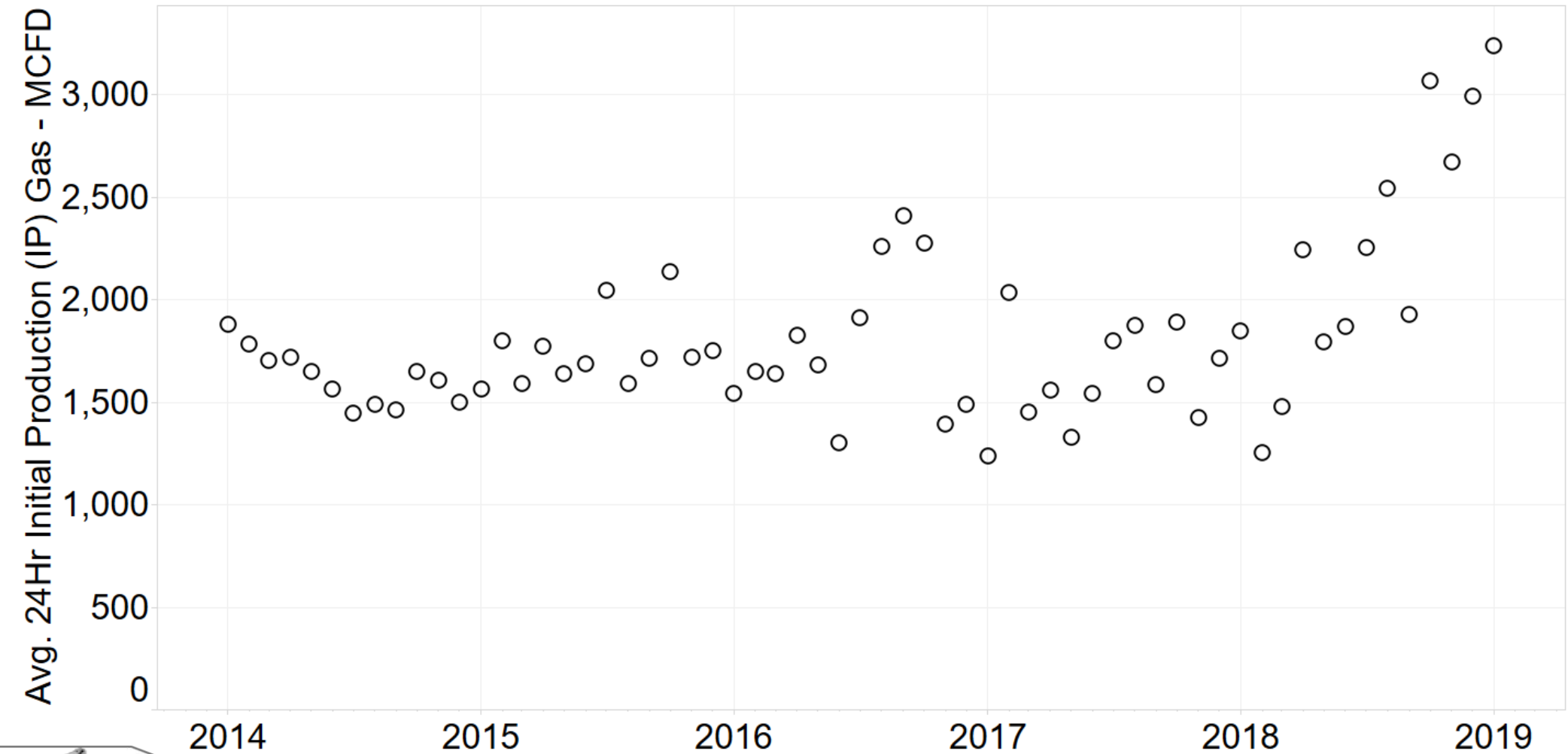
Dec. 2018 Data – Non-Confidential Wells



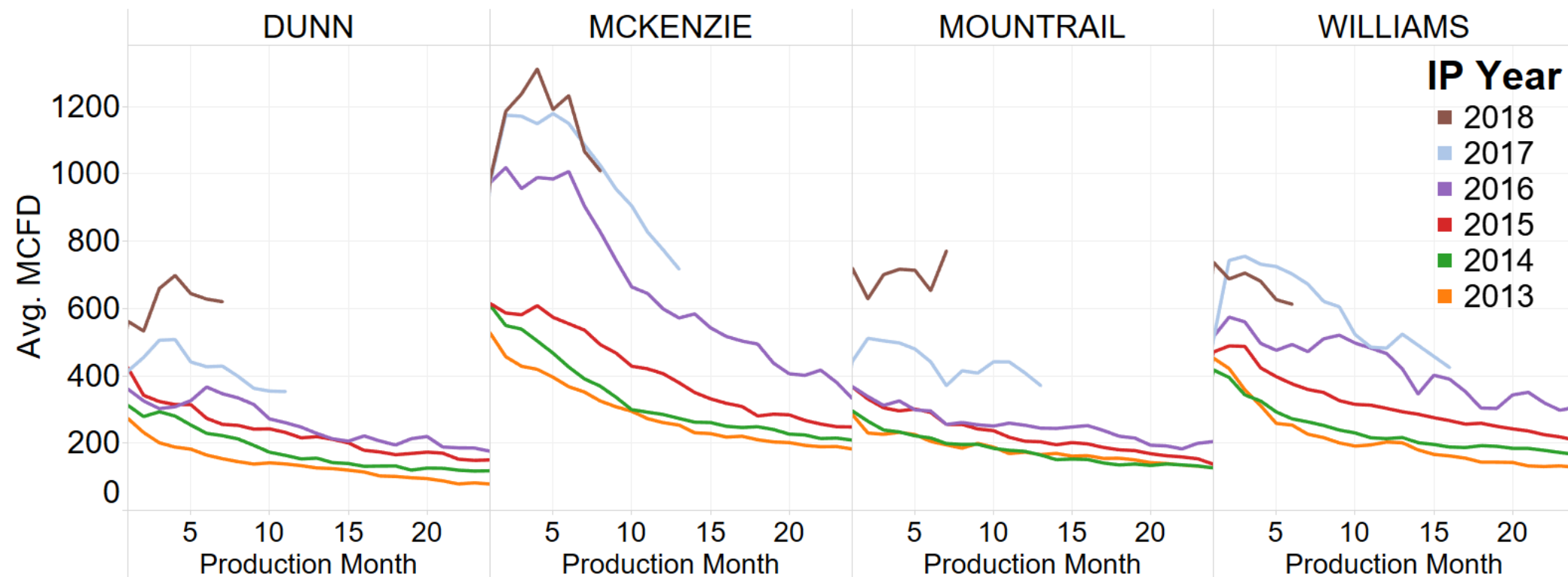
Statewide Gas Performance



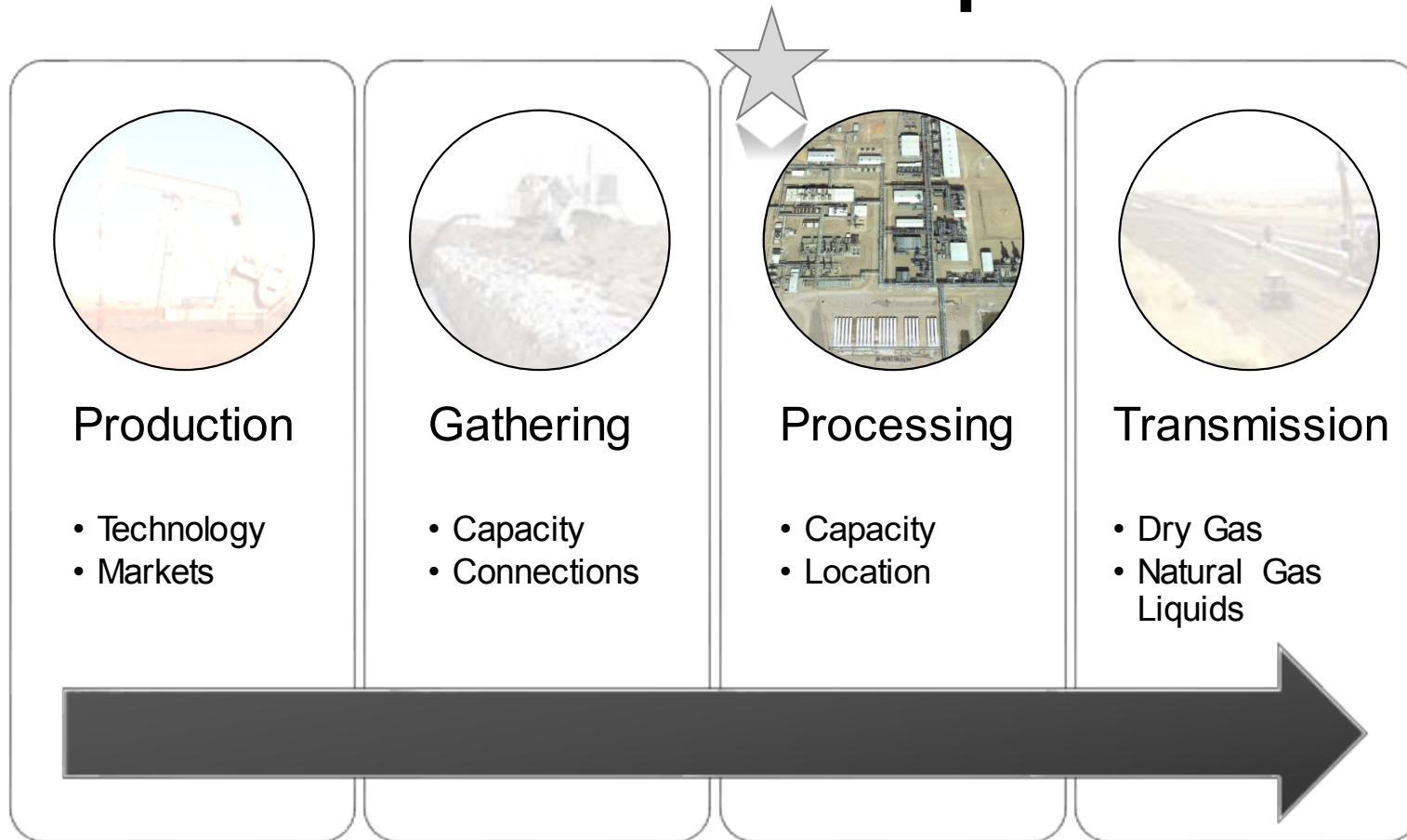
Statewide Initial Gas Production Rate: 24hr



Bakken and Three Forks Gas Performance

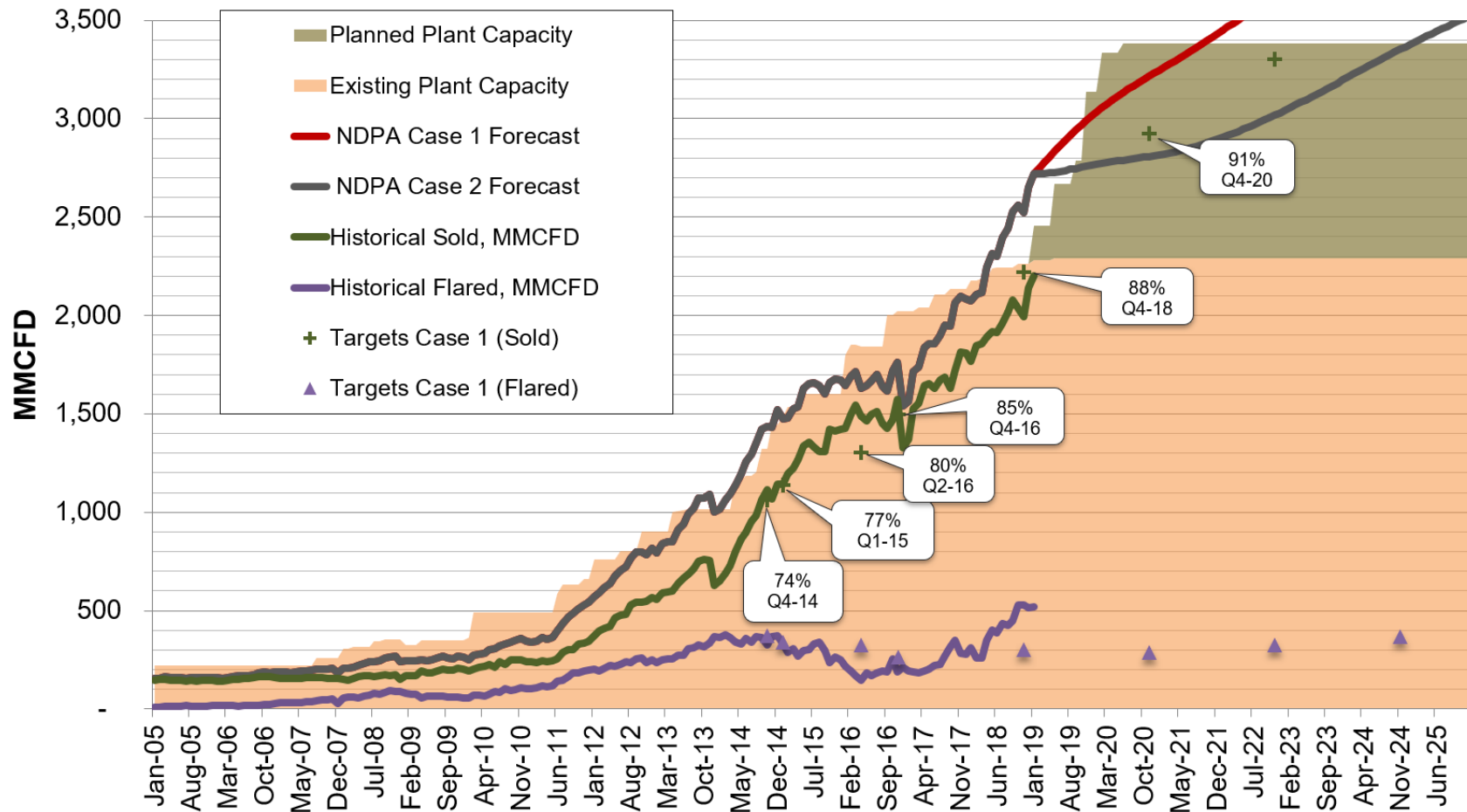


Natural Gas Update



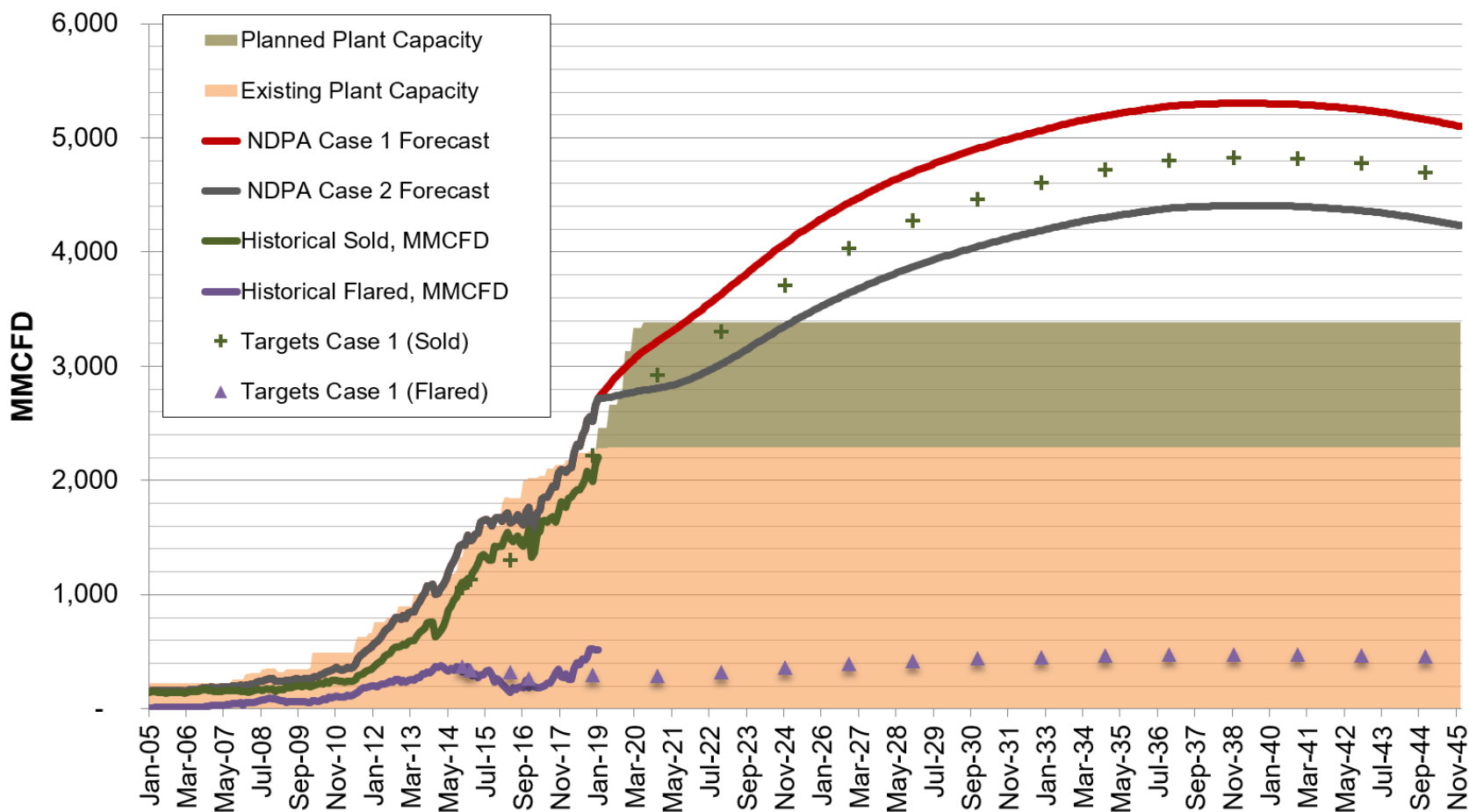
Solving the Flaring Challenge

Assumes Current Technology – Enhanced Oil Recovery Not Included

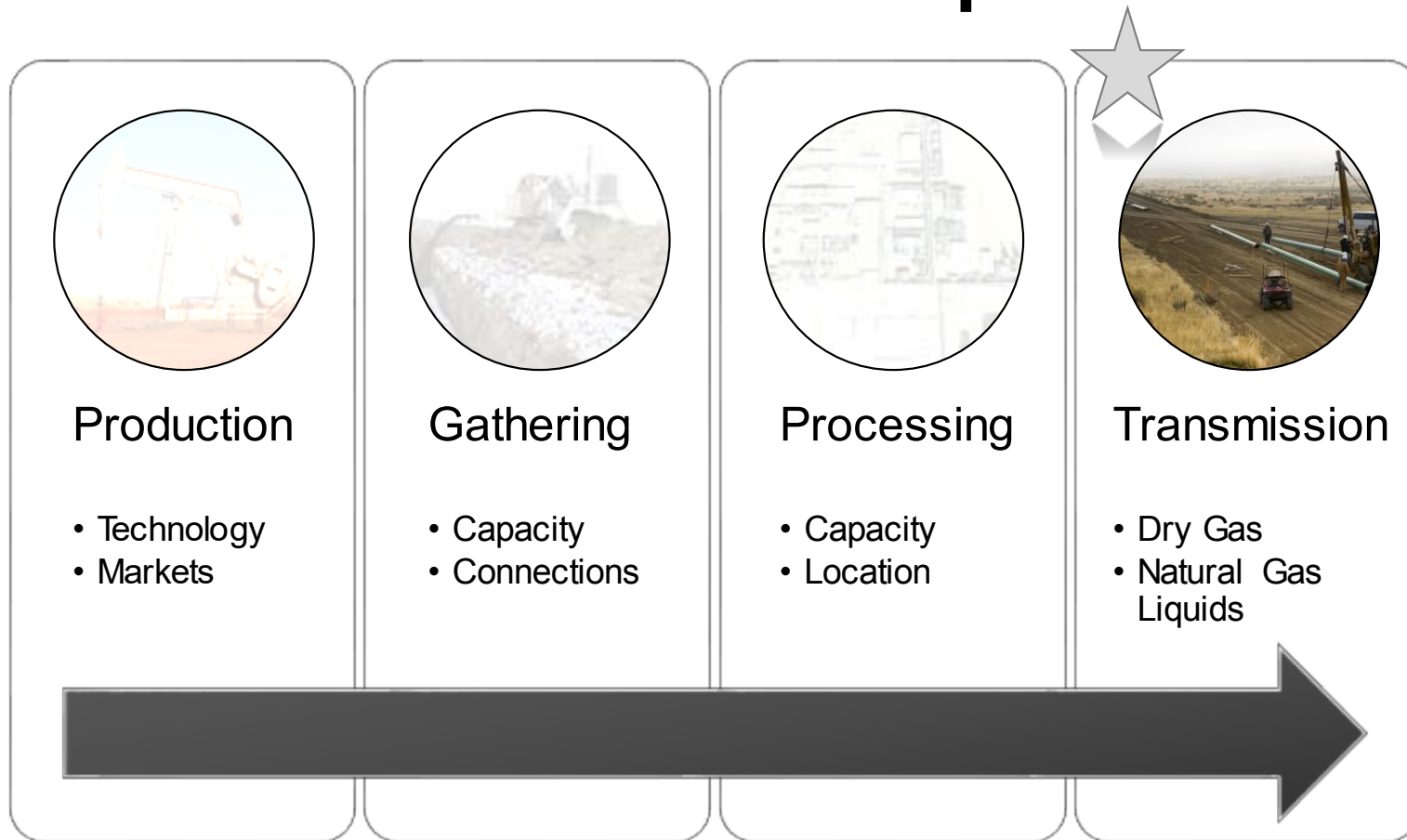


Solving the Flaring Challenge

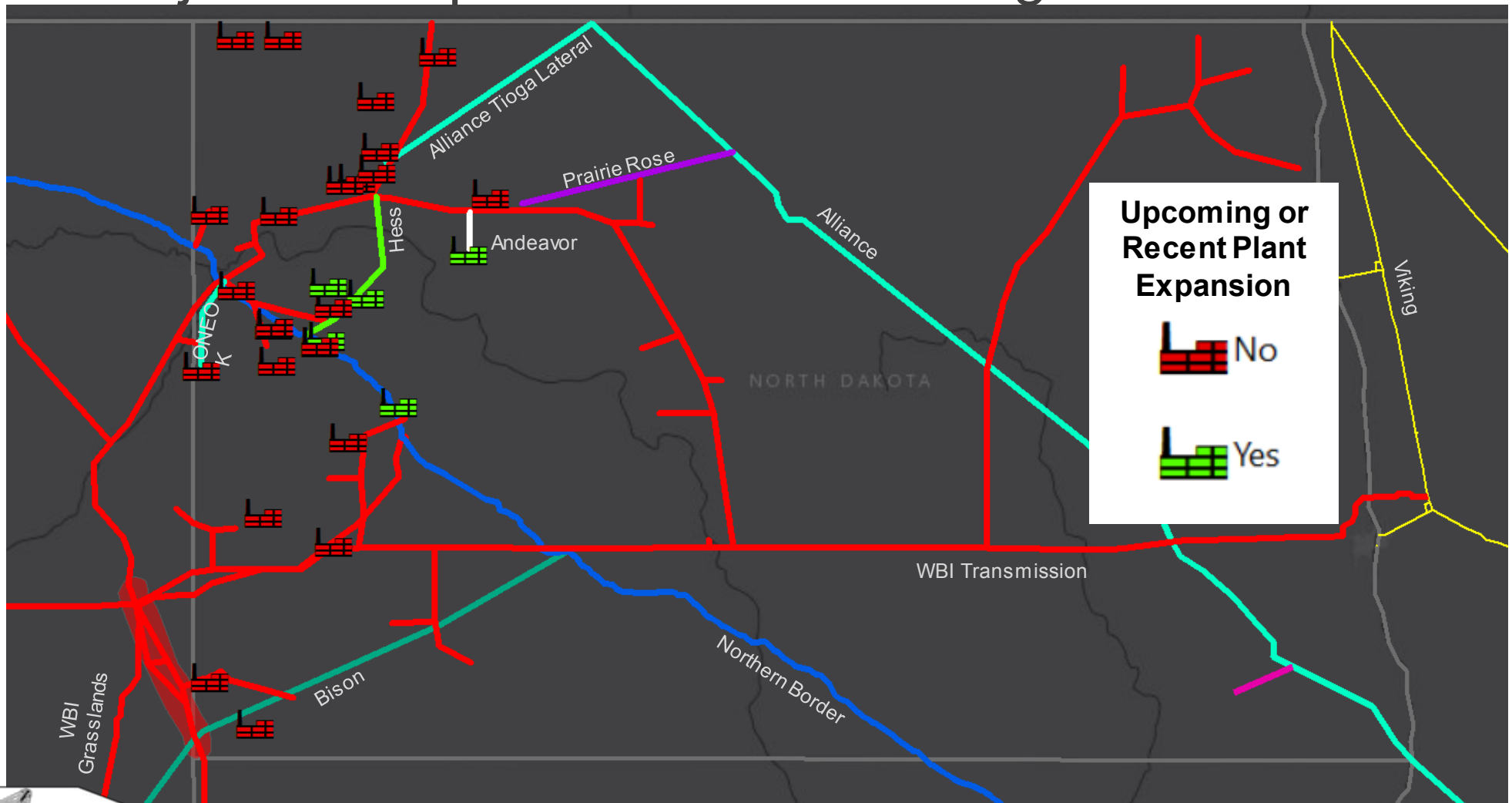
Assumes Current Technology – Enhanced Oil Recovery Not Included



Natural Gas Update

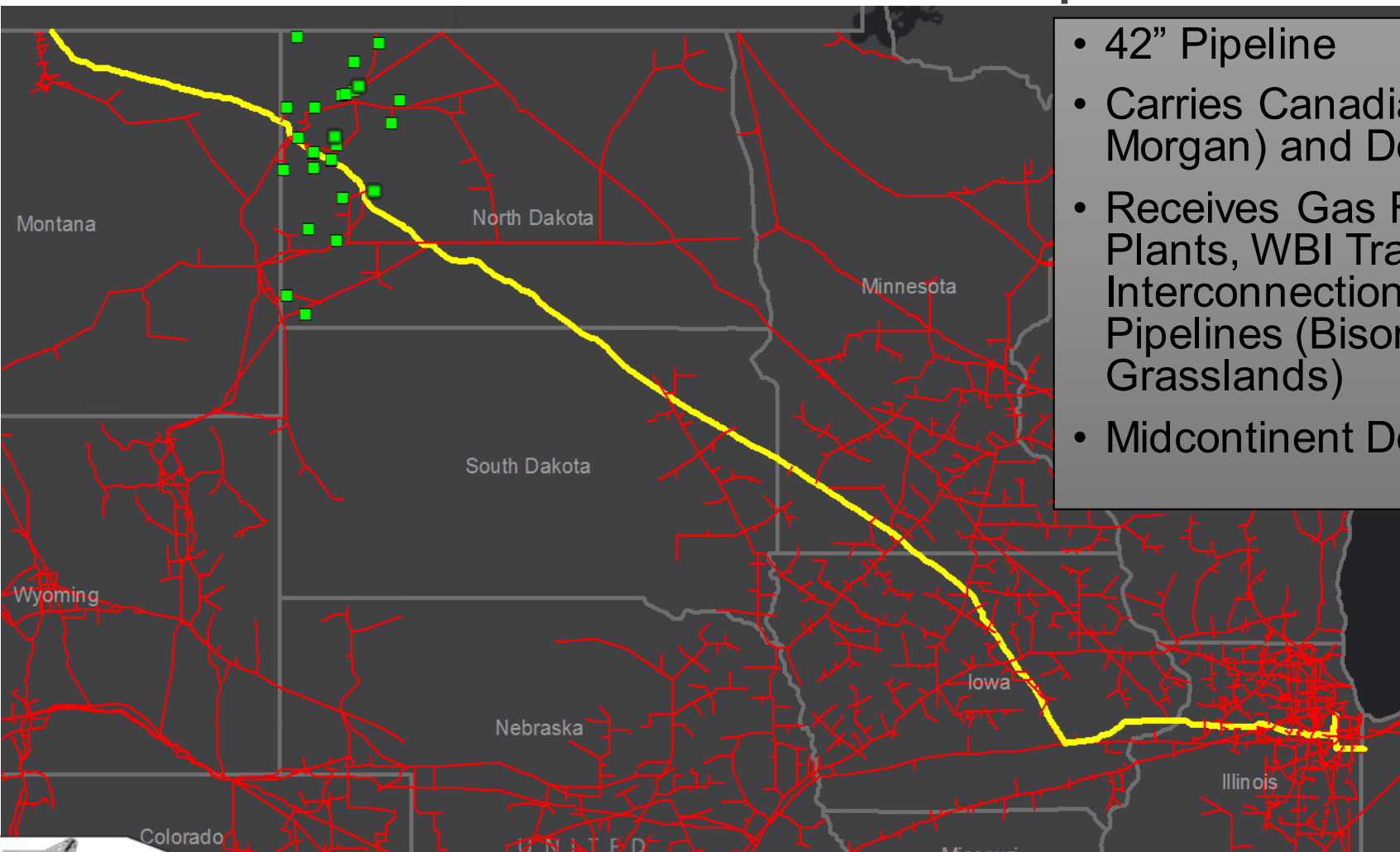


Major Gas Pipeline and Processing Infrastructure



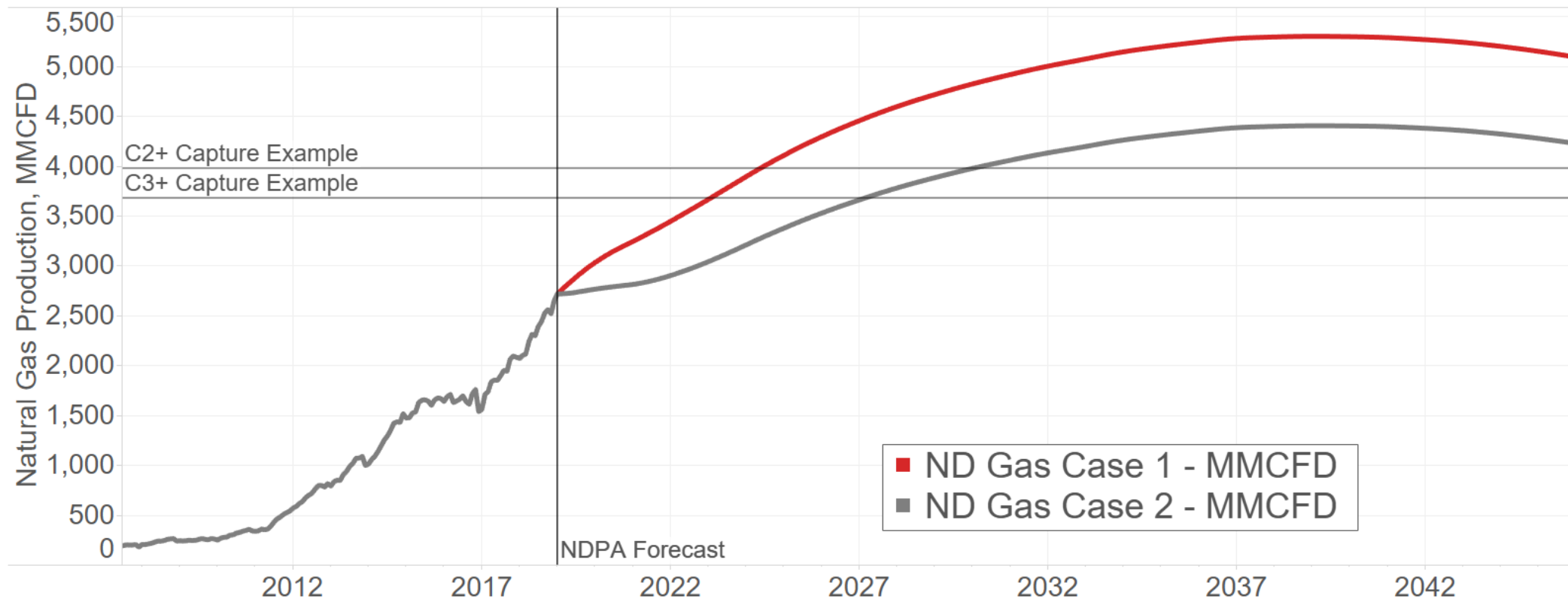
Northern Border Pipeline

- 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

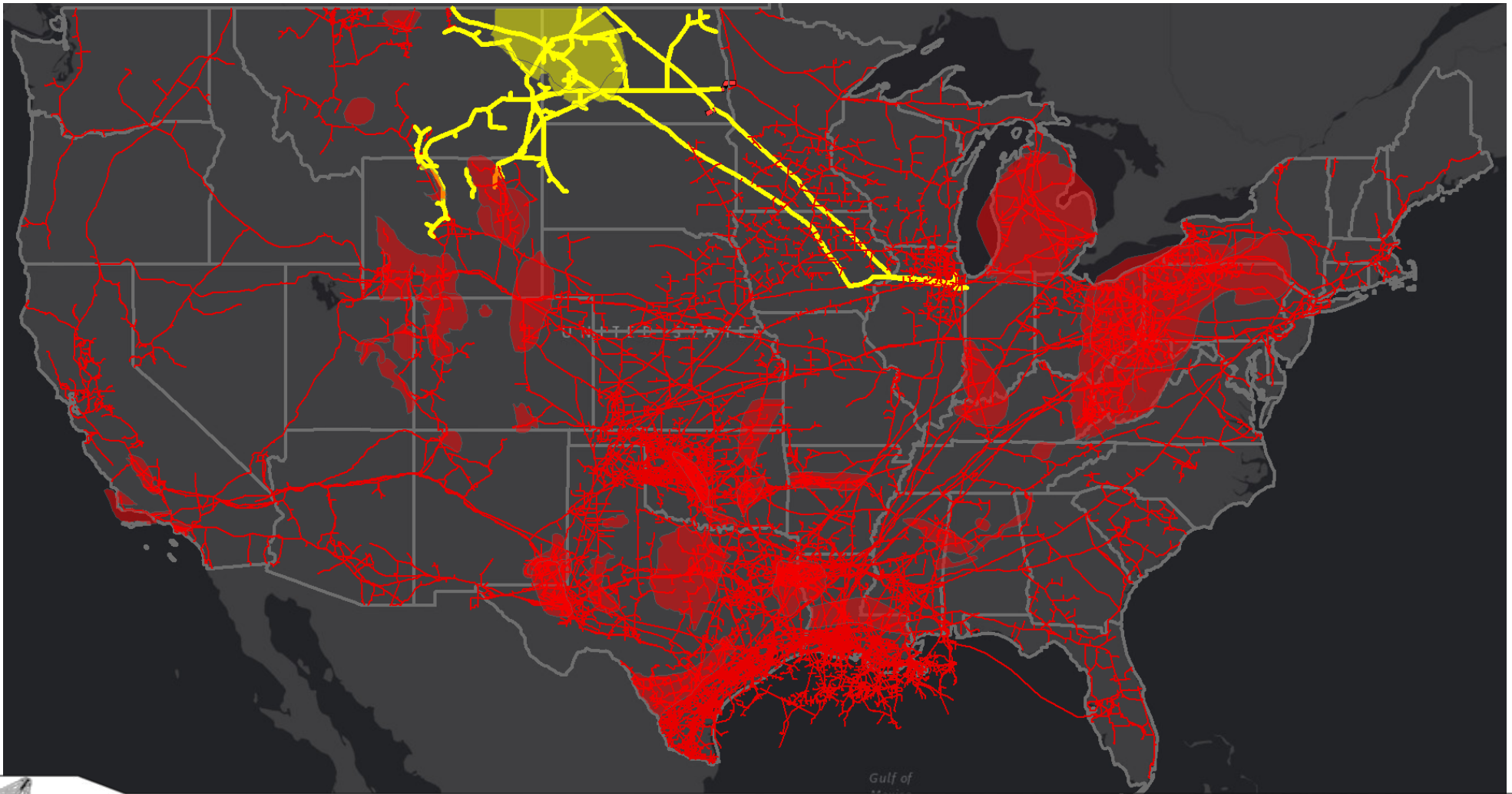


Simplified Example NB Calculations

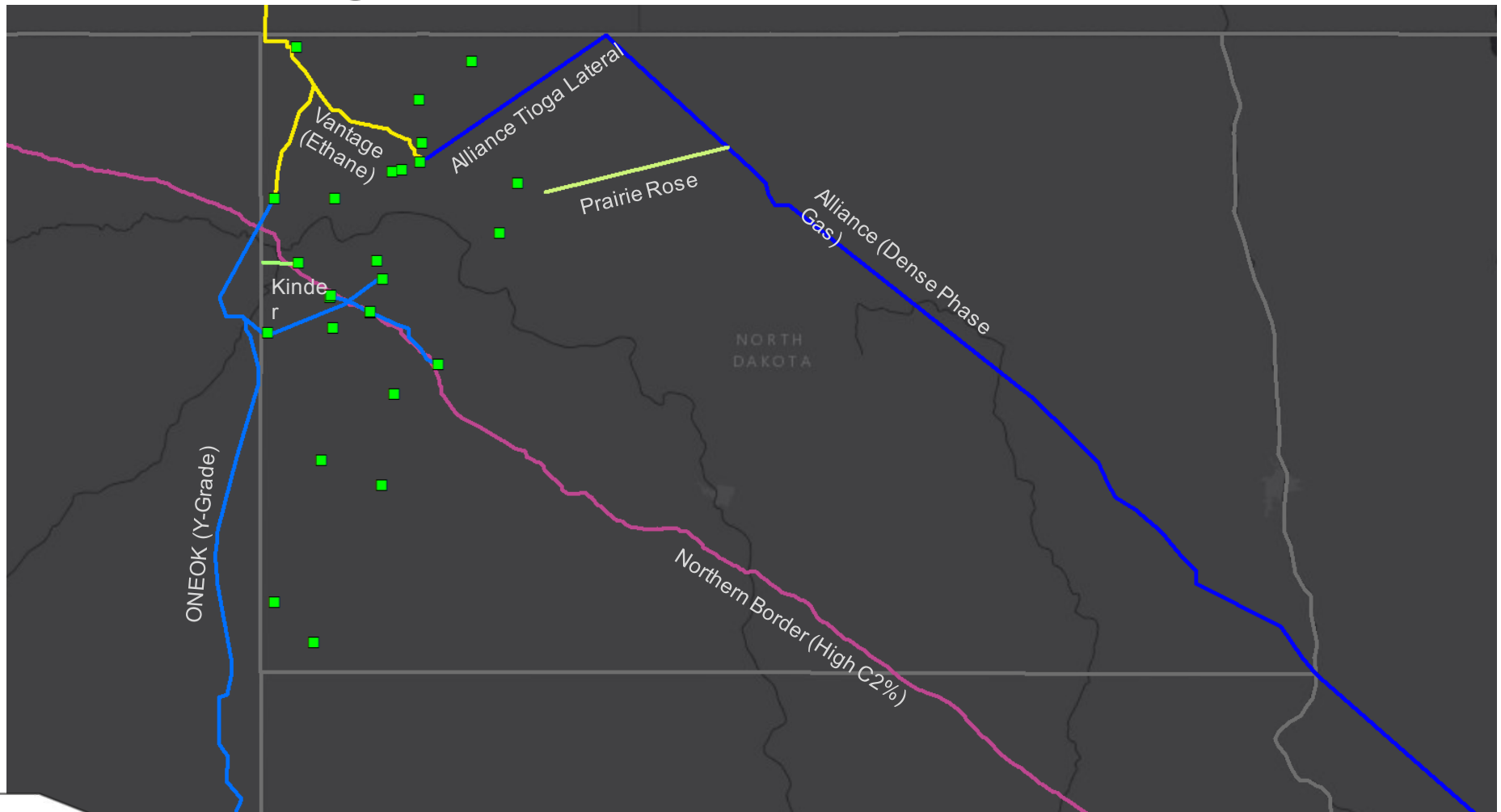
Conclusion: **IF** no other gas export options open and all other deliveries on other pipelines stay static, ND gas production could increase 0.96-1.26 BCFD (from Jan-19) before Northern Border is 100% Bakken production. **BTU management becomes increasingly important for Bakken residue gas.**



Bakken Natural Gas Infrastructure

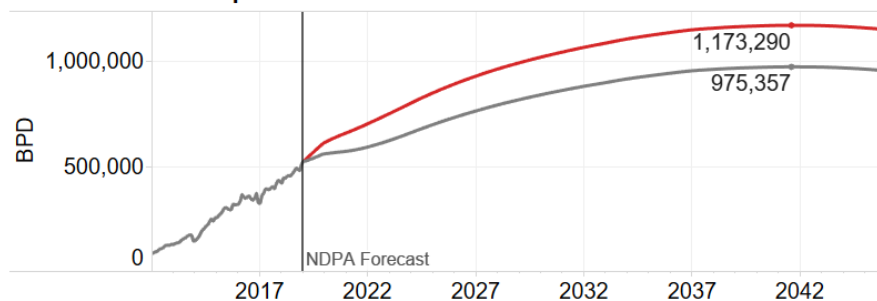


Regional NGL Infrastructure

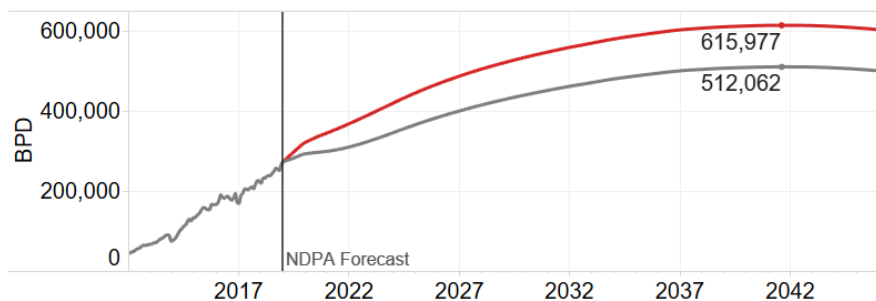


North Dakota Captured* NGL's

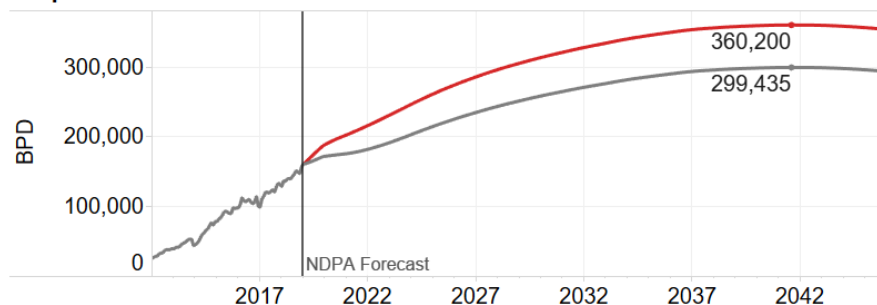
All Natural Gas Liquids



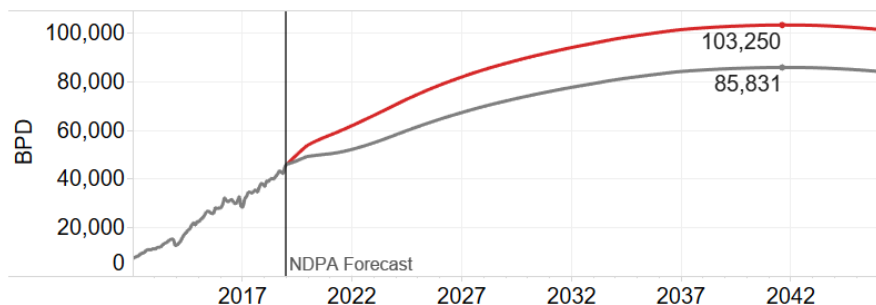
Ethane



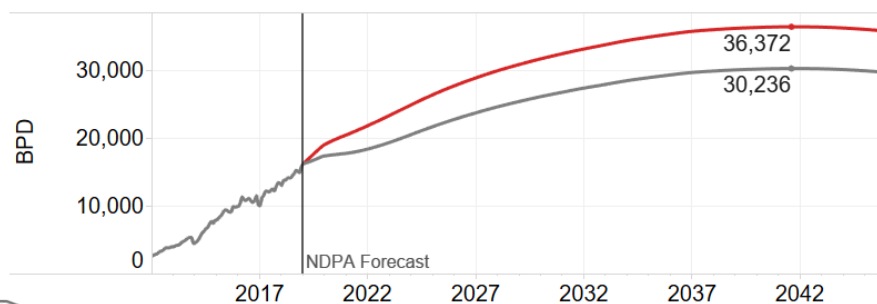
Propane



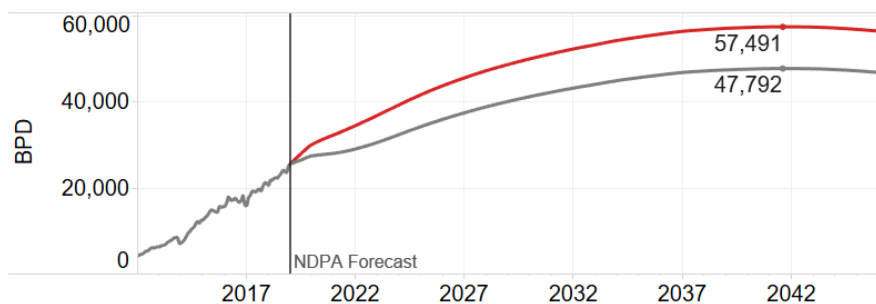
Butane



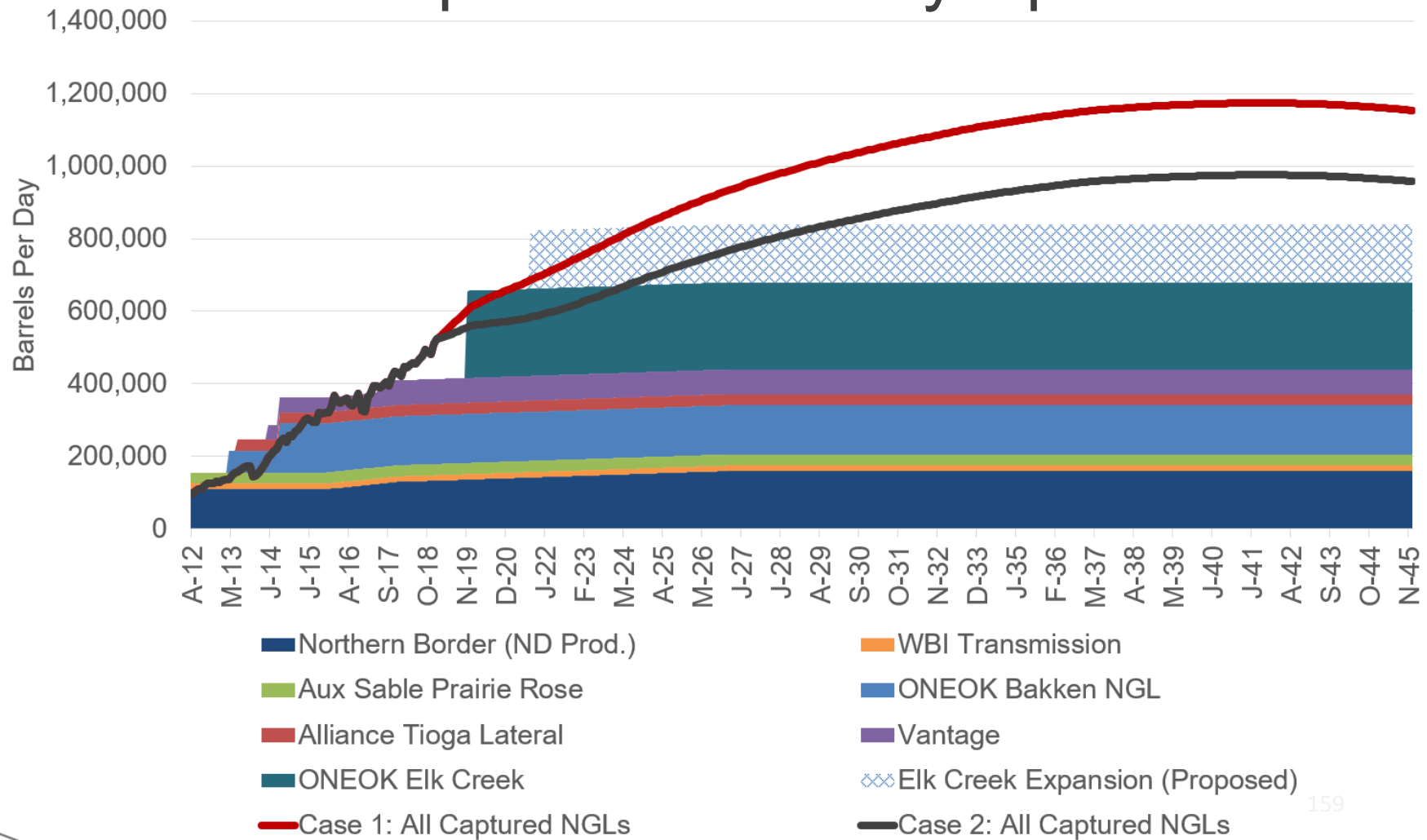
Isobutane



Natural Gasoline



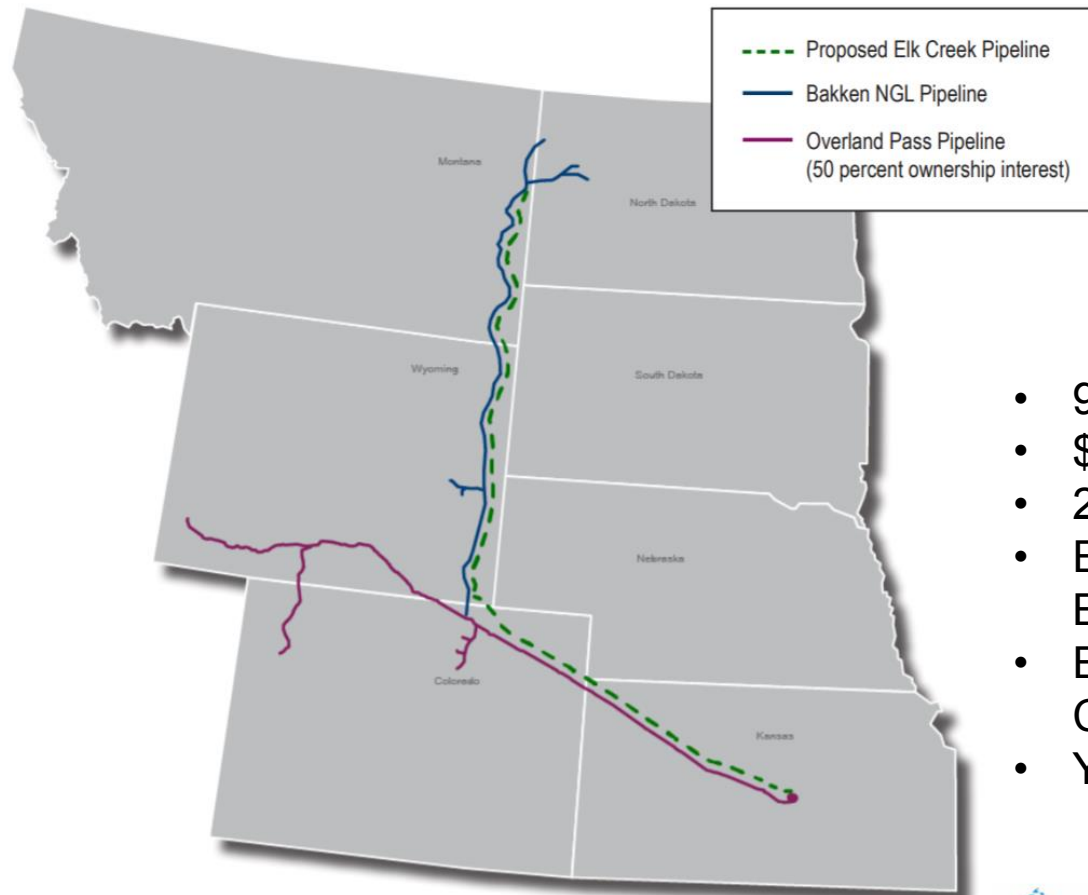
NGL Pipeline Takeaway Options



159



ONEOK Elk Creek NGL Pipeline

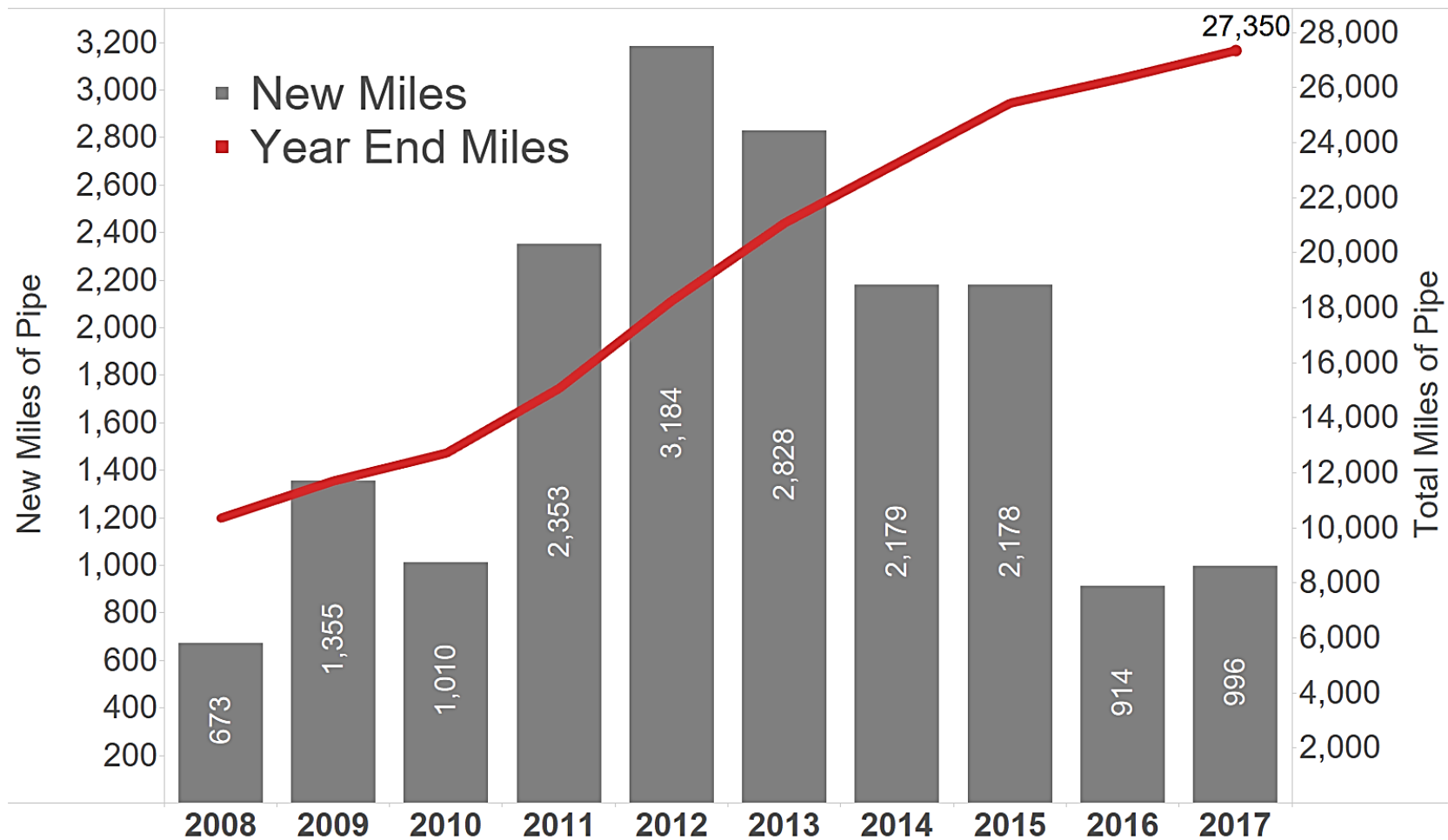


Project Highlights

- 900 Miles - 20" Pipeline
- \$1.4 Billion
- 240,000 BPD Capacity
- Expandable to 400,000 BPD
- End of 2019 Proposed Completion
- Y-Grade Transportation



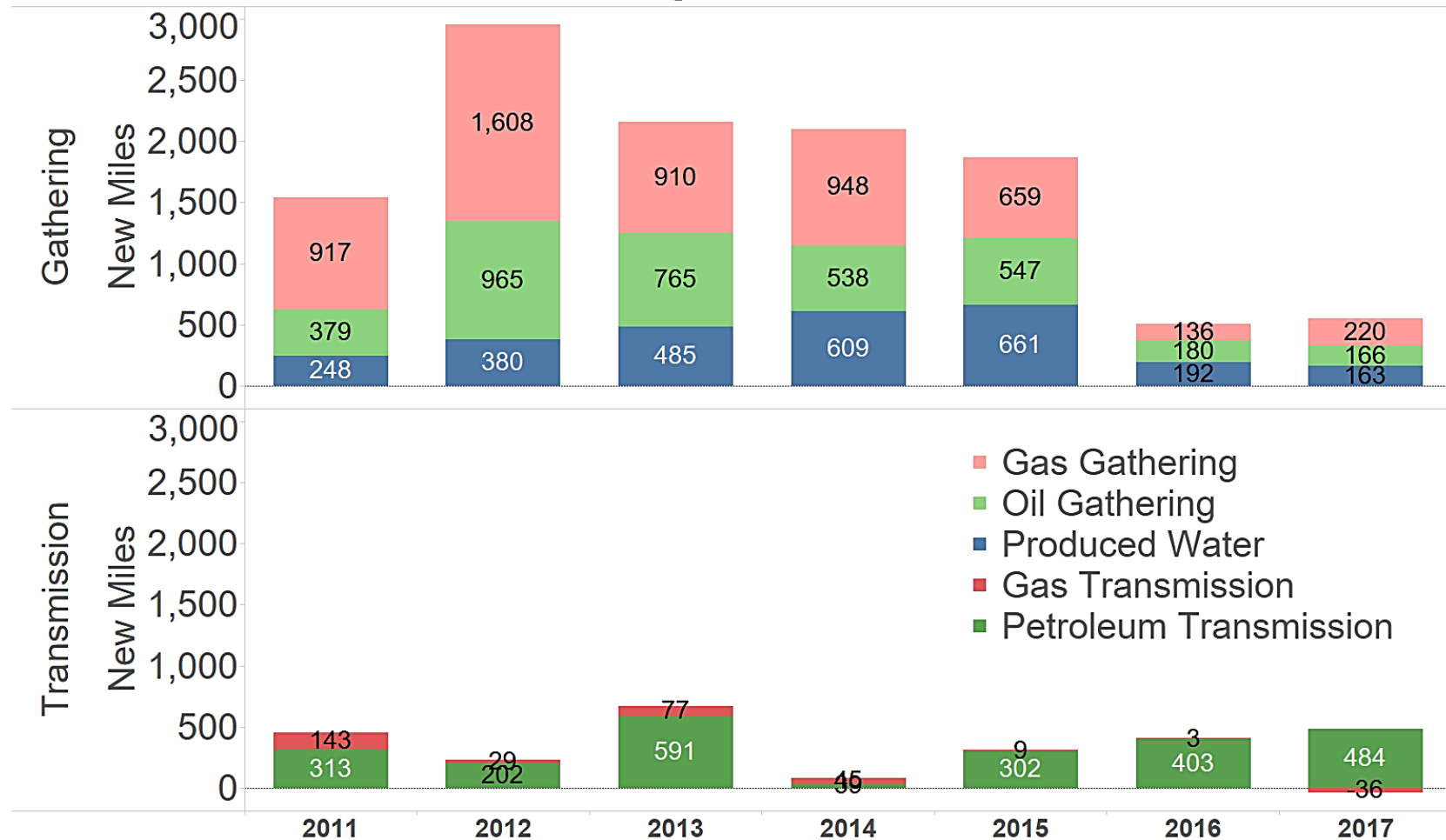
North Dakota Pipeline Construction



Sources: NDIC & PHMSA



North Dakota Pipeline Construction



Sources: NDIC & PHMSA



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



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

