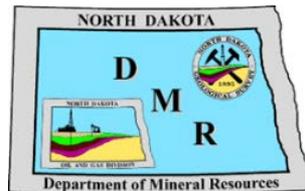


**NORTH DAKOTA  
DEPARTMENT OF MINERAL RESOURCES:**  
**OIL & GAS UPDATE**

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**January 4, 2019 | House Appropriations Committee**



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# PRODUCING WELLS

ACTIVE DRILLING RIGS

OIL & GAS PRODUCTION

OIL PRICE

ENHANCED OIL RECOVERY

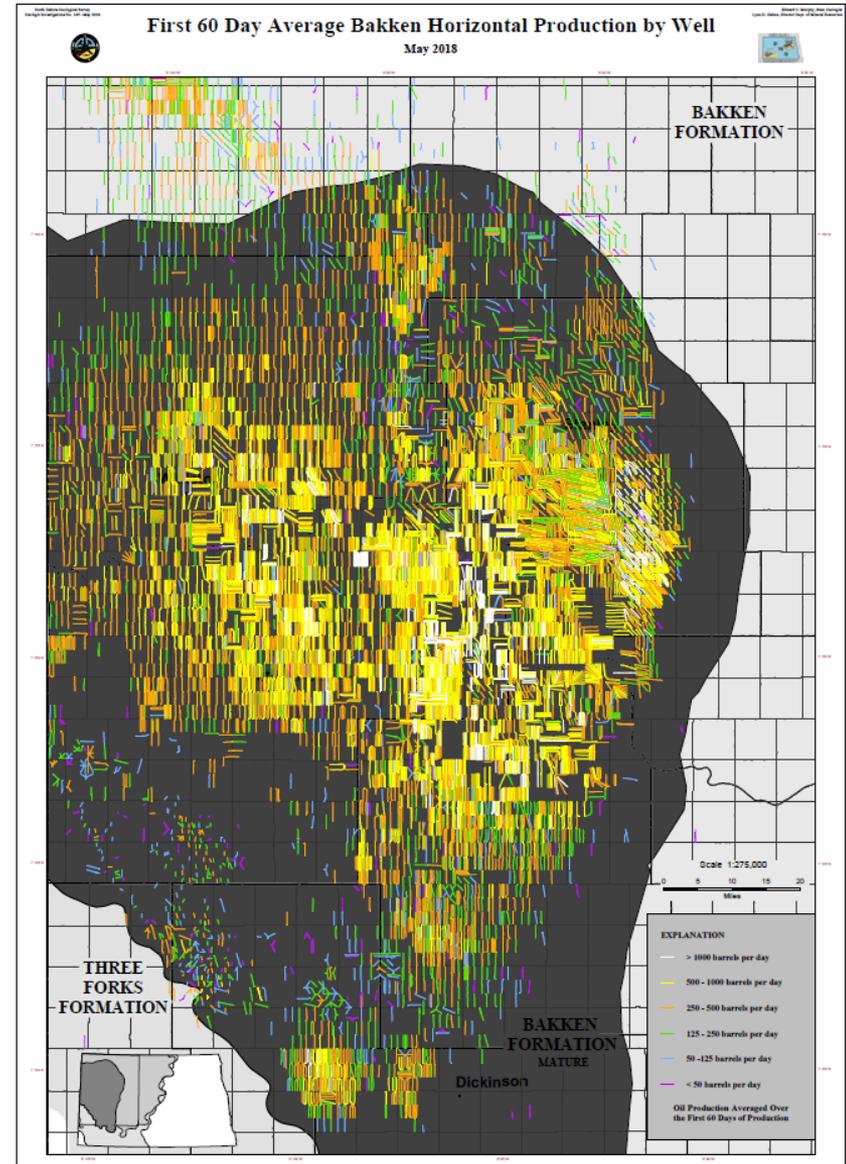
ACTIVITY FORECAST

---

# Wells



<b>Active</b>	15,344
Conventional	1,959
Bakken/Three Forks	13,385
<b>Inactive</b>	1,492 > 1,363
>\$50 for 90 days Jan 2018	
<b>Waiting on Completion</b>	877 > 959
+\$55 for 90 days Feb 2018	
<b>Permitted</b>	1,844 > 1,872
+\$60 for 90 days April 2018	
<b>Increase Density</b>	13,451 > 13,131
Approved as of 12/21/18	
<b>Total</b>	<b>32,177 &gt; 32,672</b>
<b>Estimated Final</b>	<b>40,000 - 85,000</b>
<b>\$60-80/BO &amp; 60-70 rigs</b>	<b>20 - 70 years</b>



PRODUCING WELLS

**ACTIVE DRILLING RIGS**

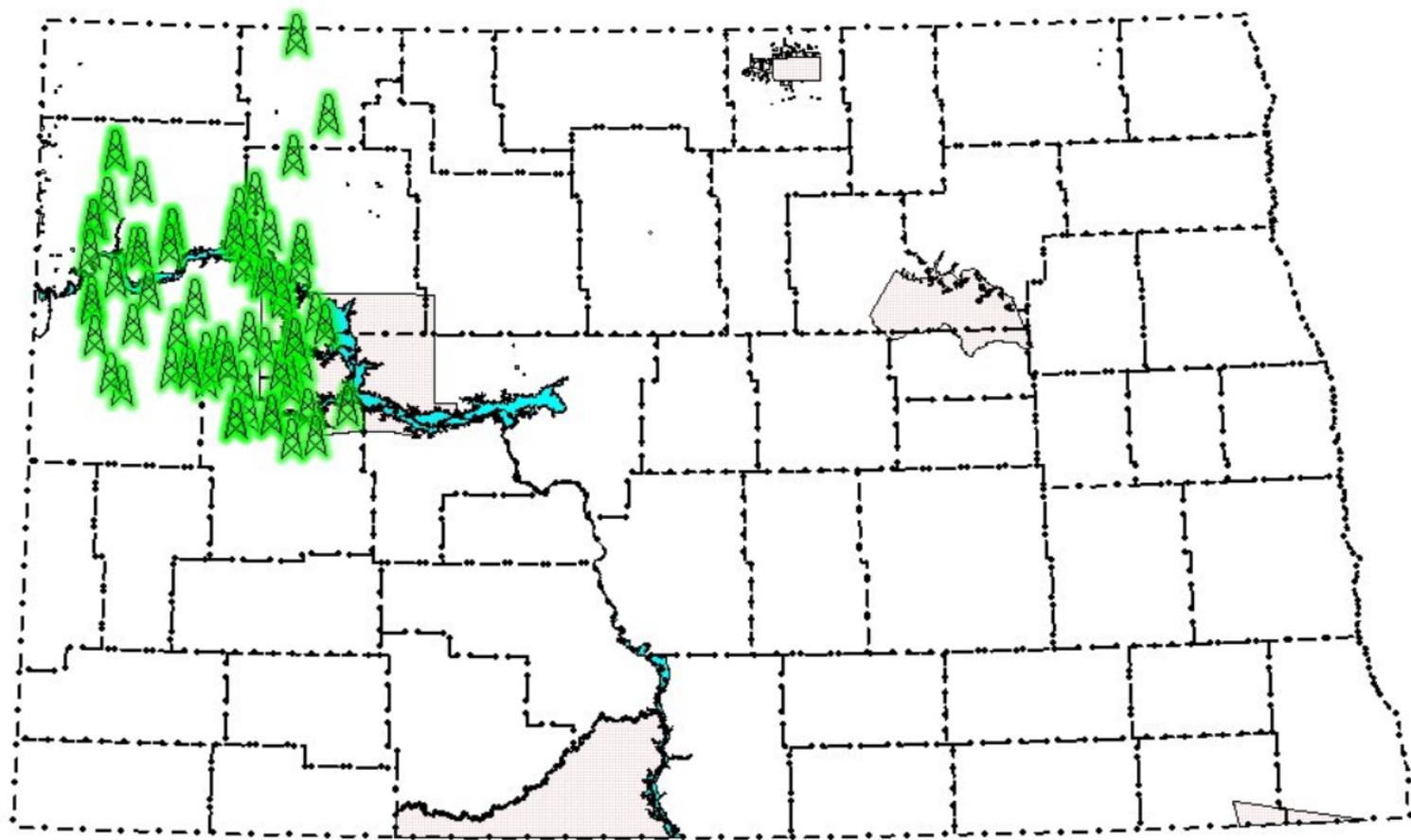
OIL & GAS PRODUCTION

OIL PRICE

ENHANCED OIL RECOVERY

ACTIVITY FORECAST

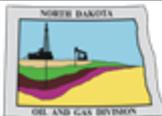
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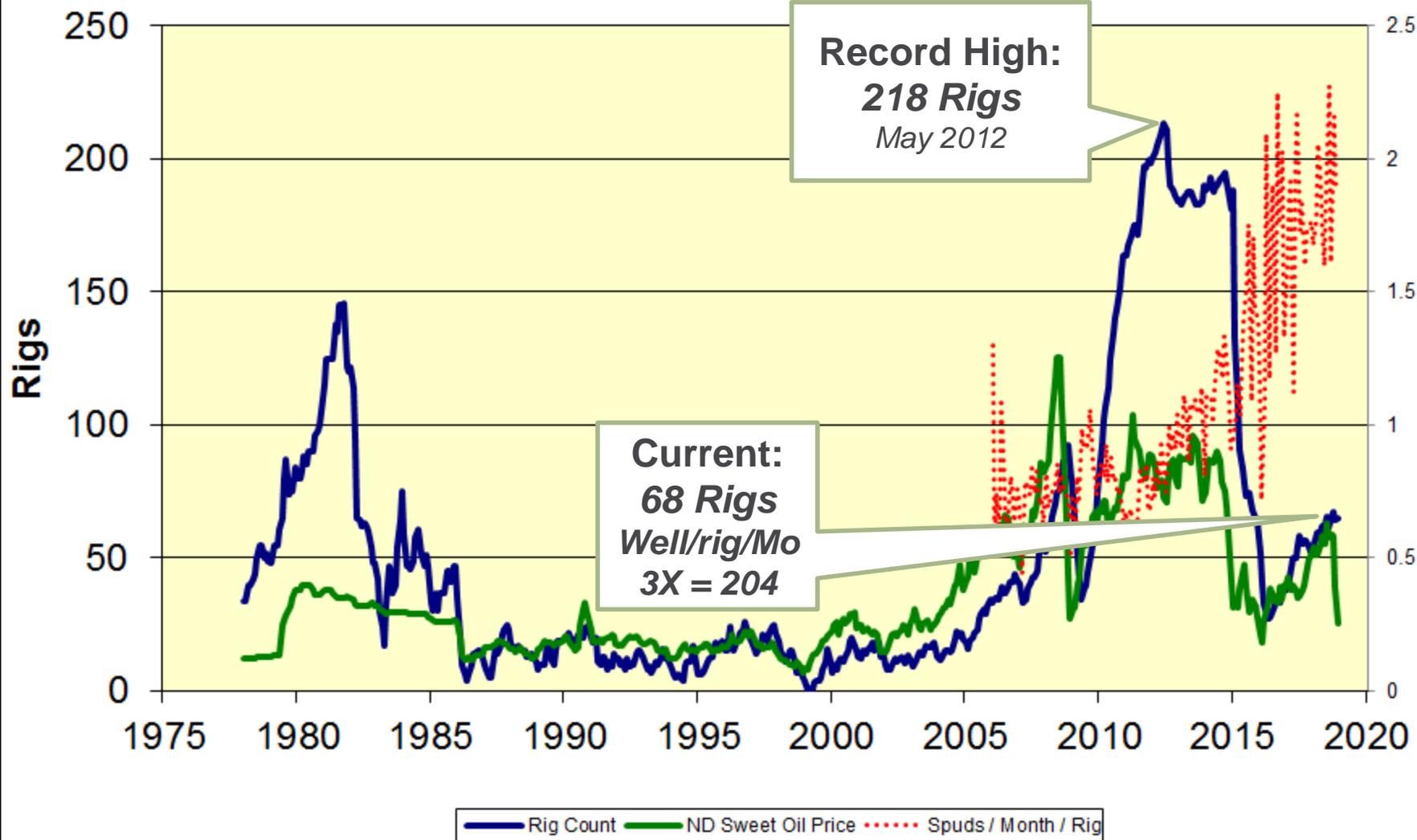
0 82mi

# Rigs - 65



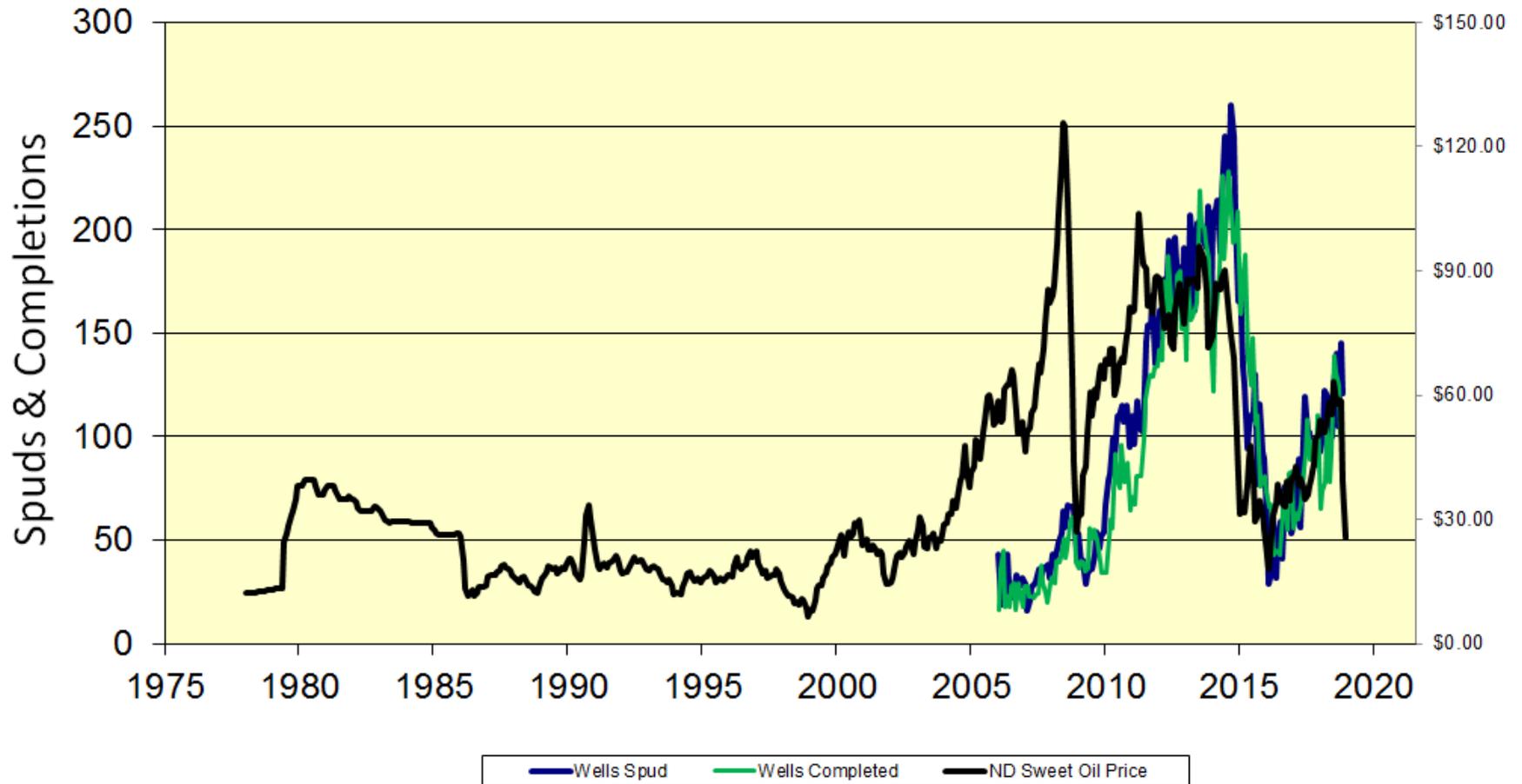


# North Dakota Average Monthly Rig Count



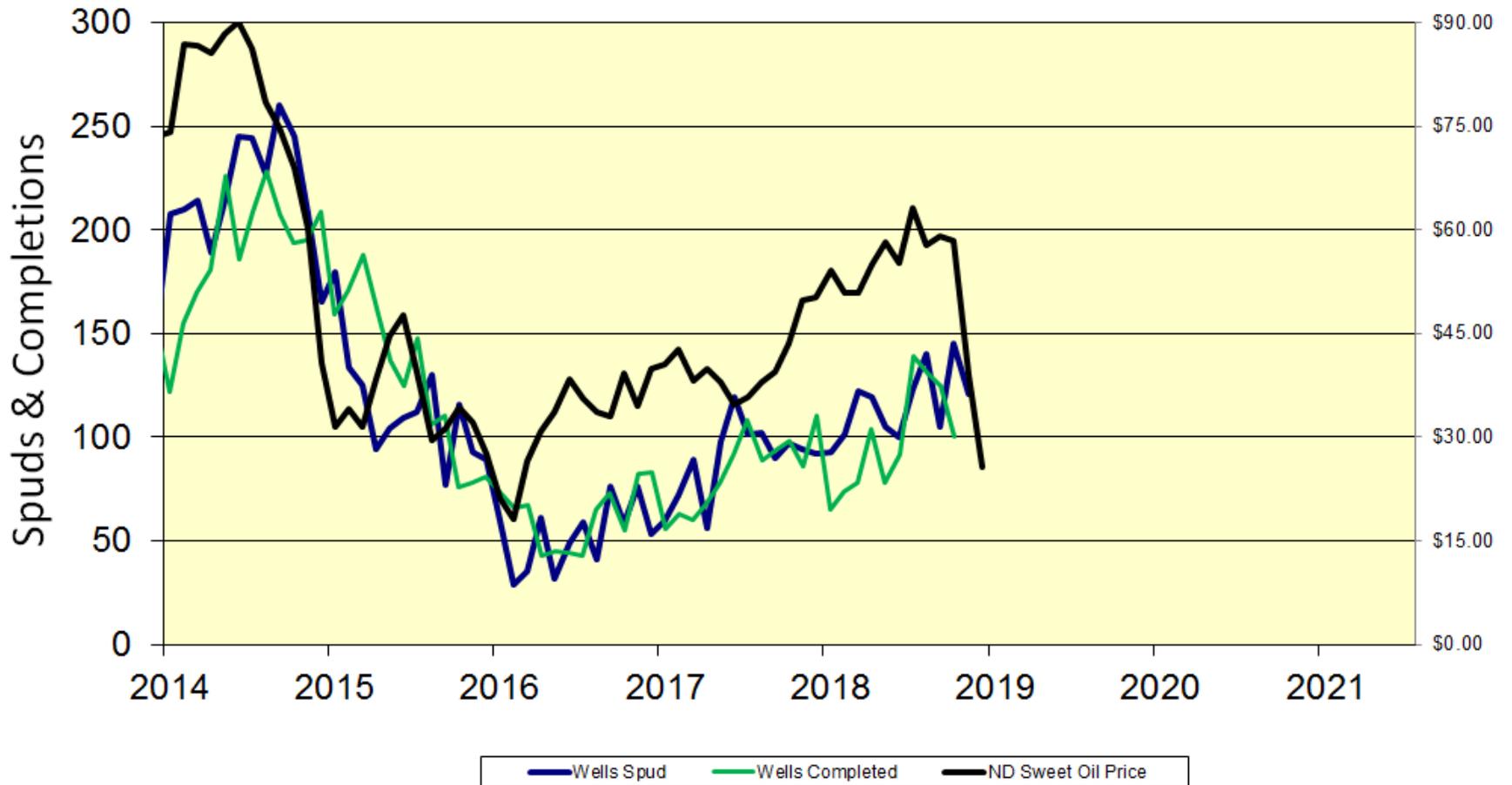


## North Dakota Monthly Spuds & Completions





## North Dakota Monthly Spuds & Completions

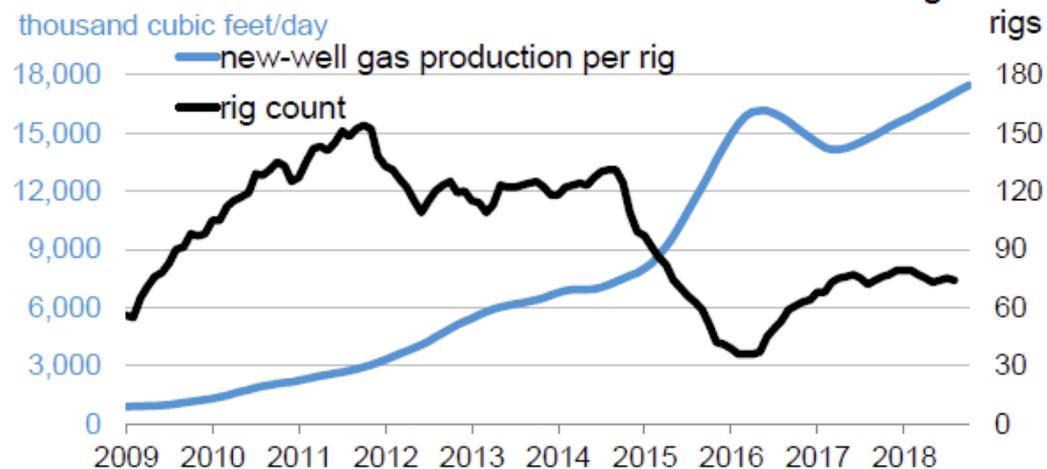


# OIL & GAS PRODUCTIVITY

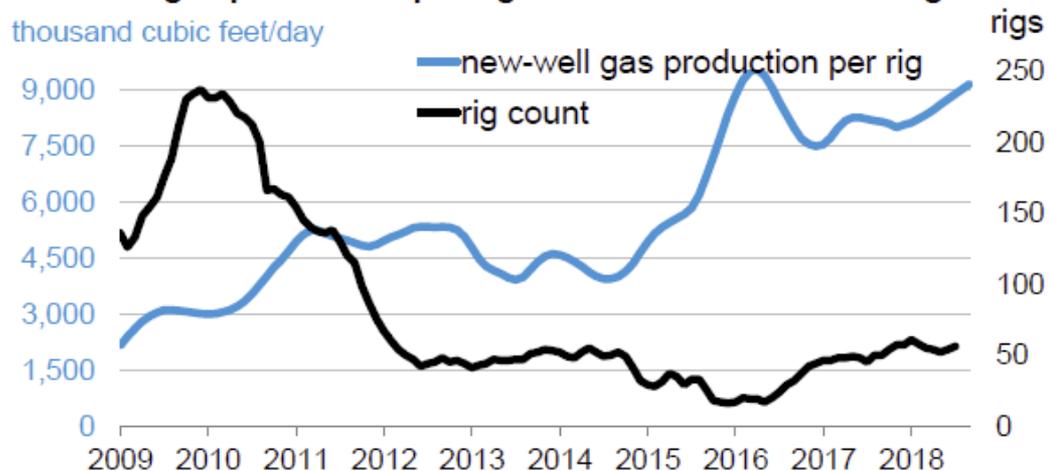
FRACTURING TECHNOLOGY

ENHANCED OIL RECOVERY

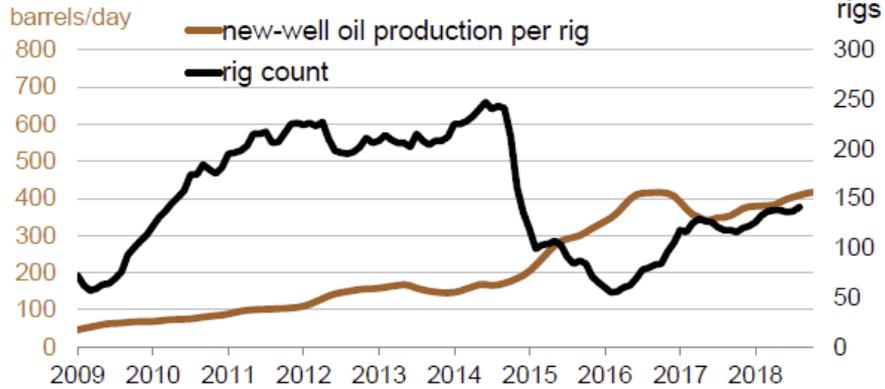
### Appalachia Region New-well gas production per rig



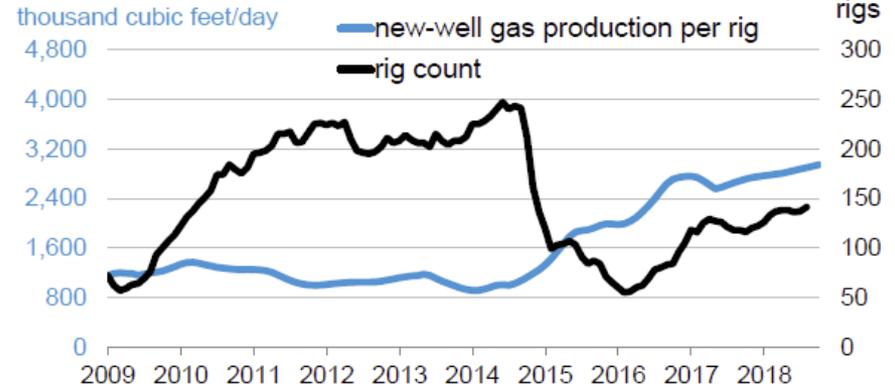
### Haynesville Region New-well gas production per rig



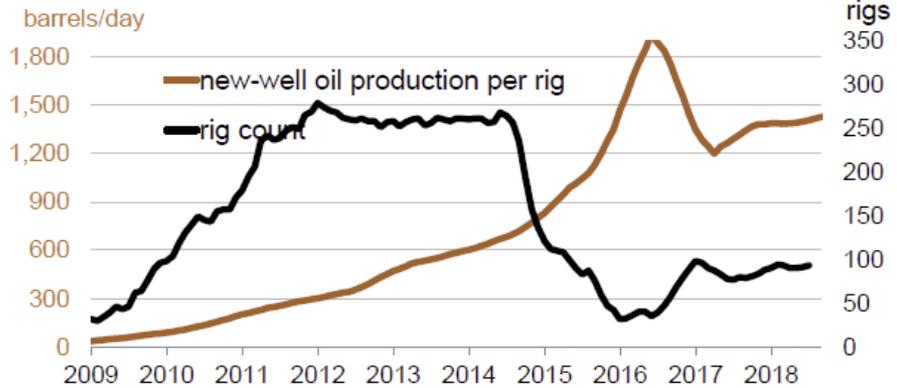
Anadarko Region  
New-well oil production per rig



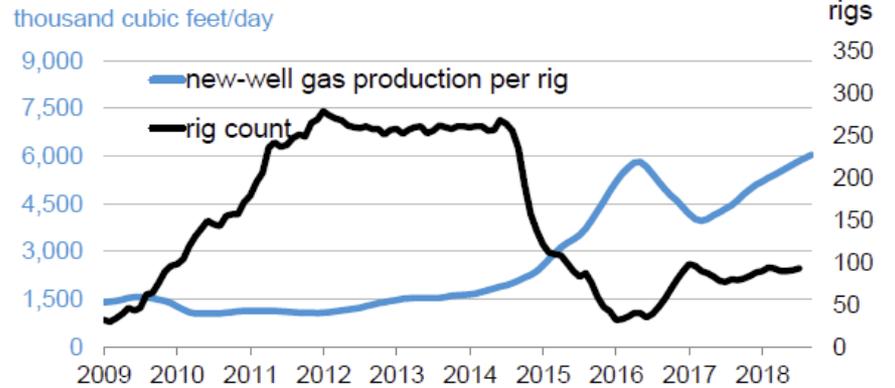
Anadarko Region  
New-well gas production per rig

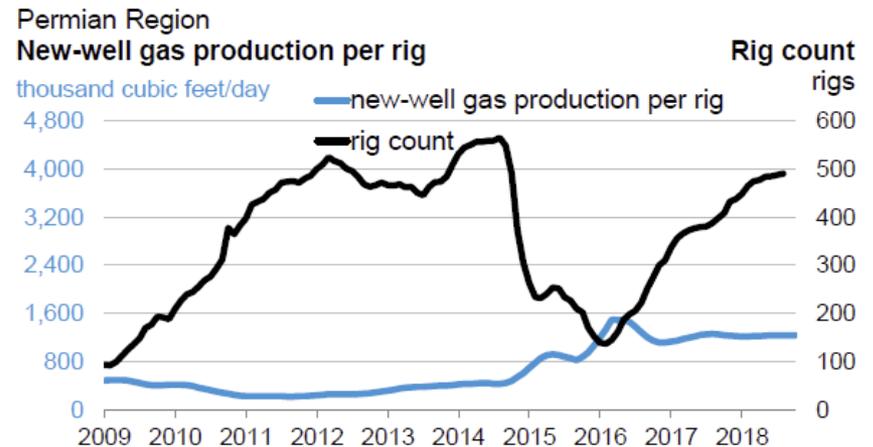
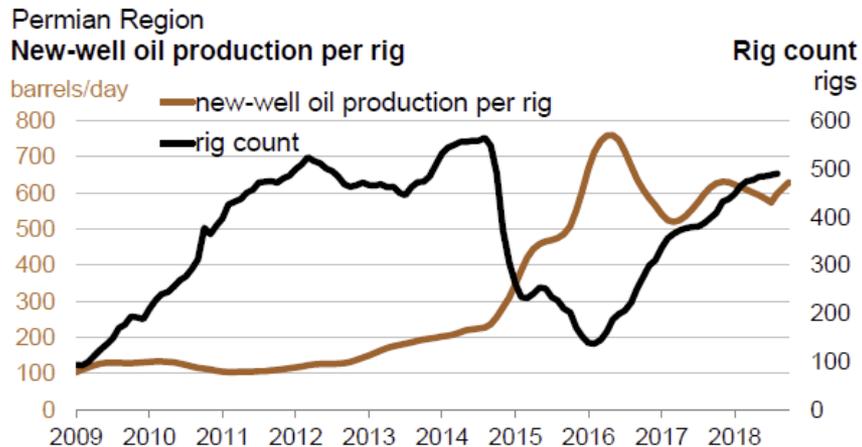
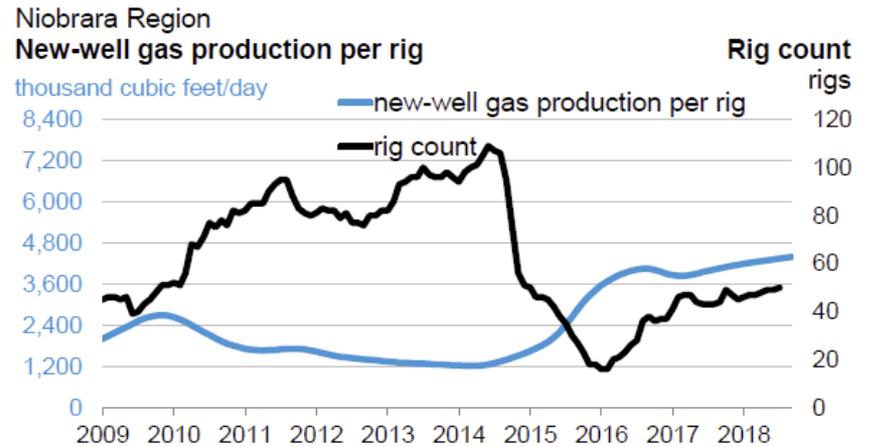
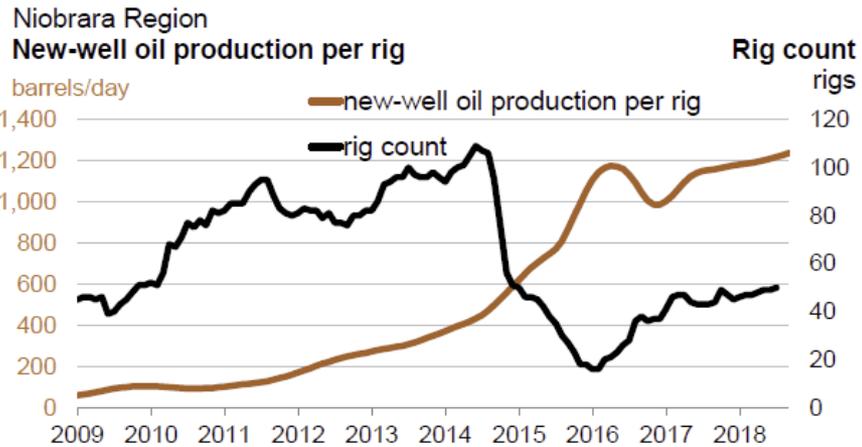


Eagle Ford Region  
New-well oil production per rig



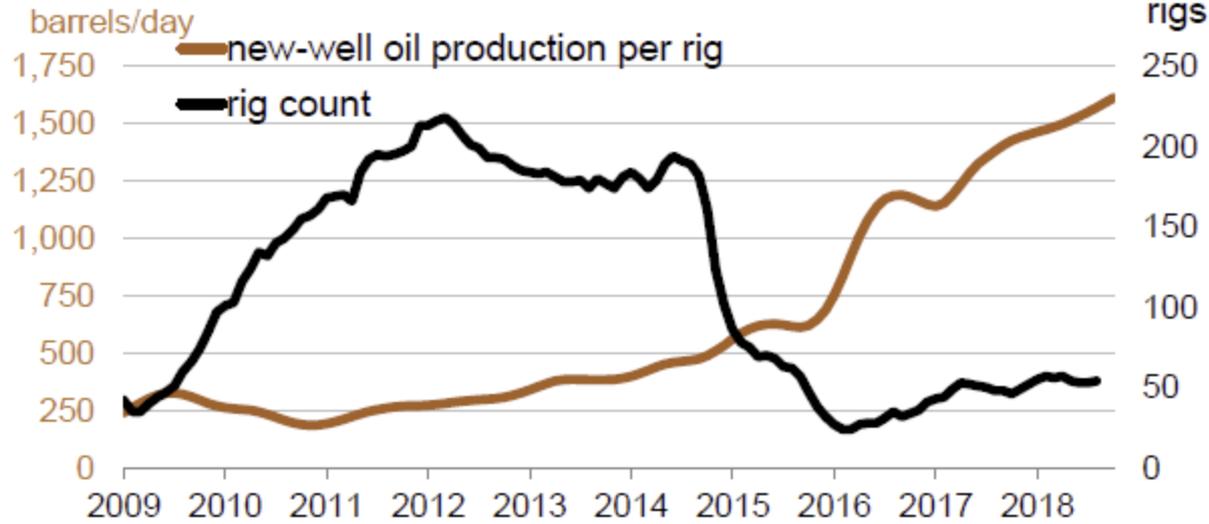
Eagle Ford Region  
New-well gas production per rig





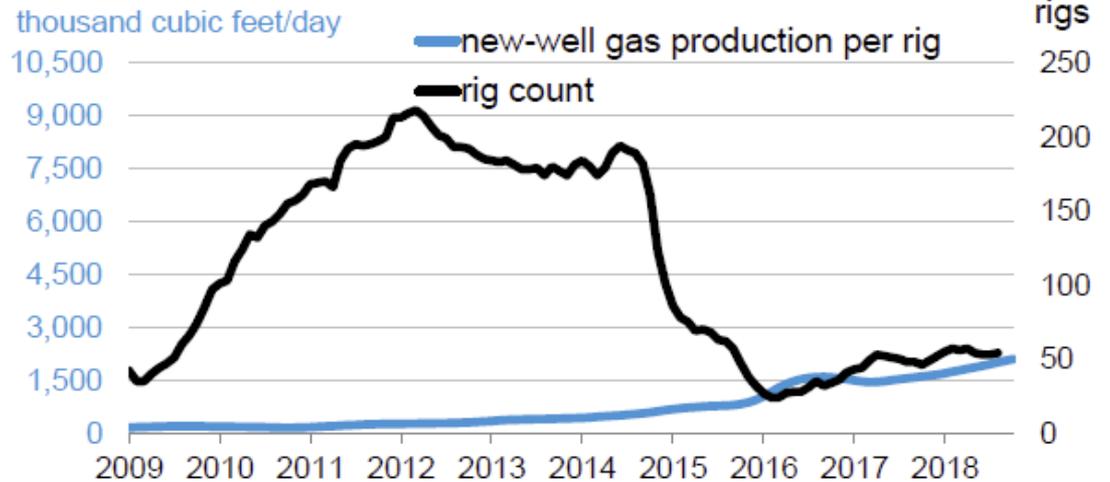
### Bakken Region

#### New-well oil production per rig



### Bakken Region

#### New-well gas production per rig



OIL & GAS PRODUCTIVITY

**FRACTURING TECHNOLOGY**

ENHANCED OIL RECOVERY

# TYPICAL G1 HORIZONTAL OIL WELL



**Marathon Oil Company**

Case No. 9633 And  
Case No. 9606  
Exhibit E-2  
Schematic Well Diagram  
Application Extending Outline Of Bailey Field  
And Proposed Drilling Units  
Dunn County, North Dakota  
August 22, 2007

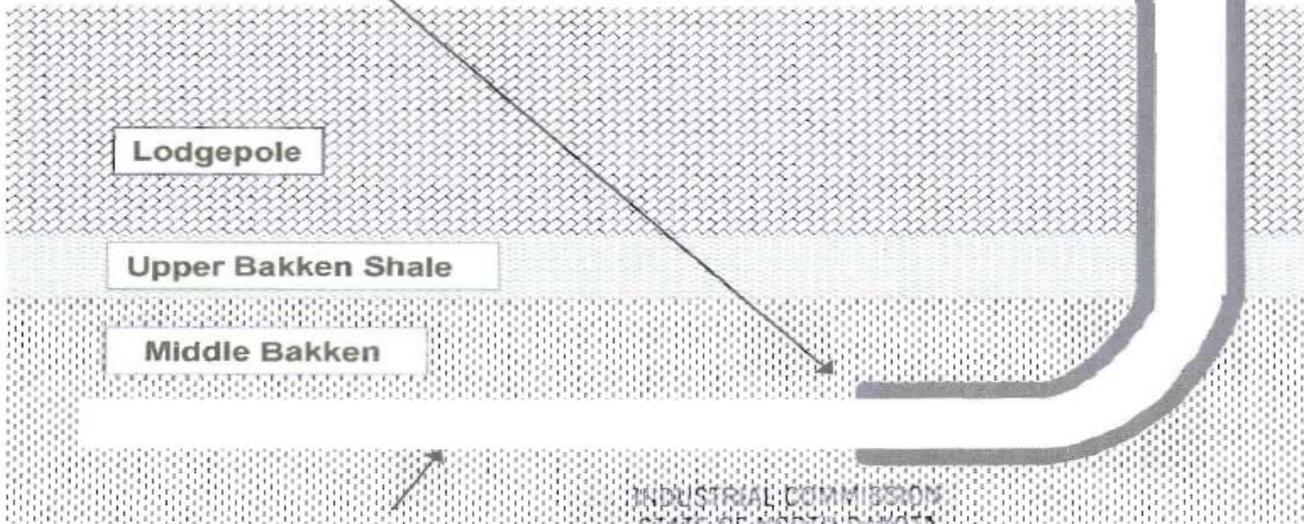
16" Conductor set @ 60'-80'  
13 1/2" Hole Diameter

Set 9 5/8" 36# K55 LT&C Surface  
Casing @ 1800' and Cement

Potable Waters

8 3/4"  
Hole  
Size  
  
7"  
Casing

Casing shoe Approximately 650' from  
Vertical Hole. KOP in Lodgepole.



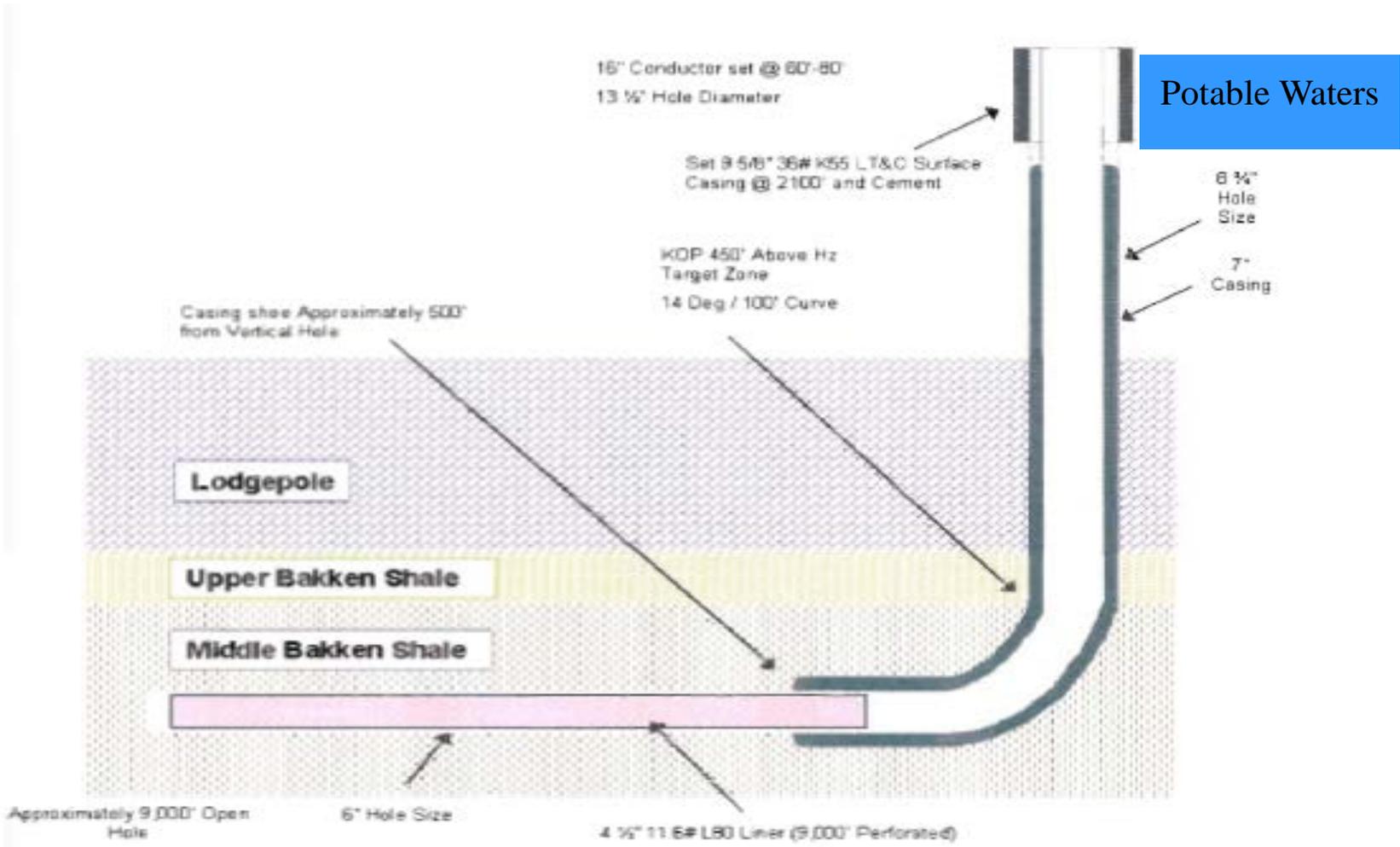
Approximately 900' Open  
Hole

6" Hole Size

INDUSTRIAL COMMISSION  
STATE OF NORTH DAKOTA  
DATE 8/22/07 CASE NO. 9633/9606

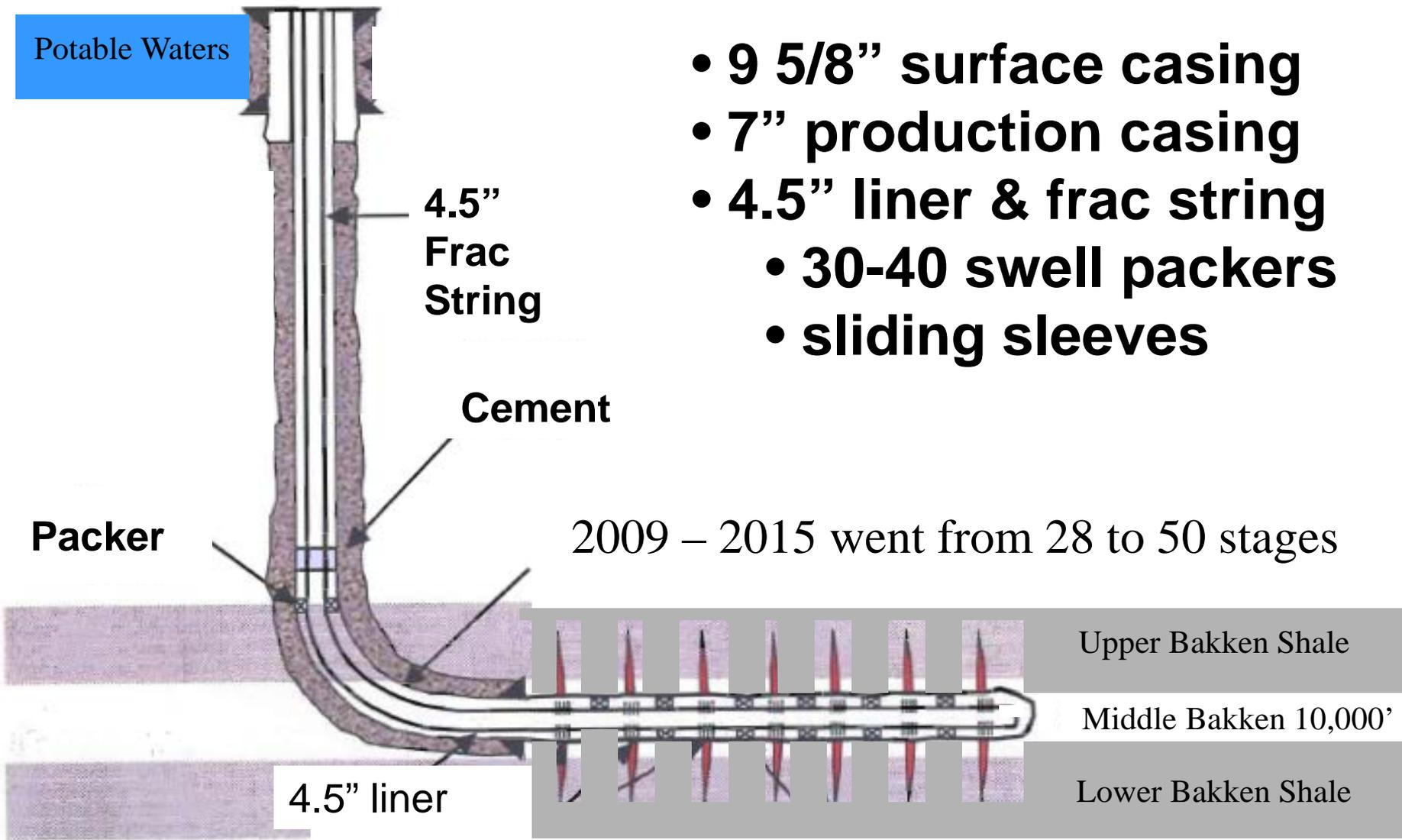
98 gallons cross link gel and 149 pounds sand per foot

# TYPICAL G2 HORIZONTAL OIL WELL



236 gallons cross link gel and 154 pounds sand per foot

# TYPICAL G3 HORIZONTAL OIL WELL



- 9 5/8" surface casing
- 7" production casing
- 4.5" liner & frac string
  - 30-40 swell packers
  - sliding sleeves

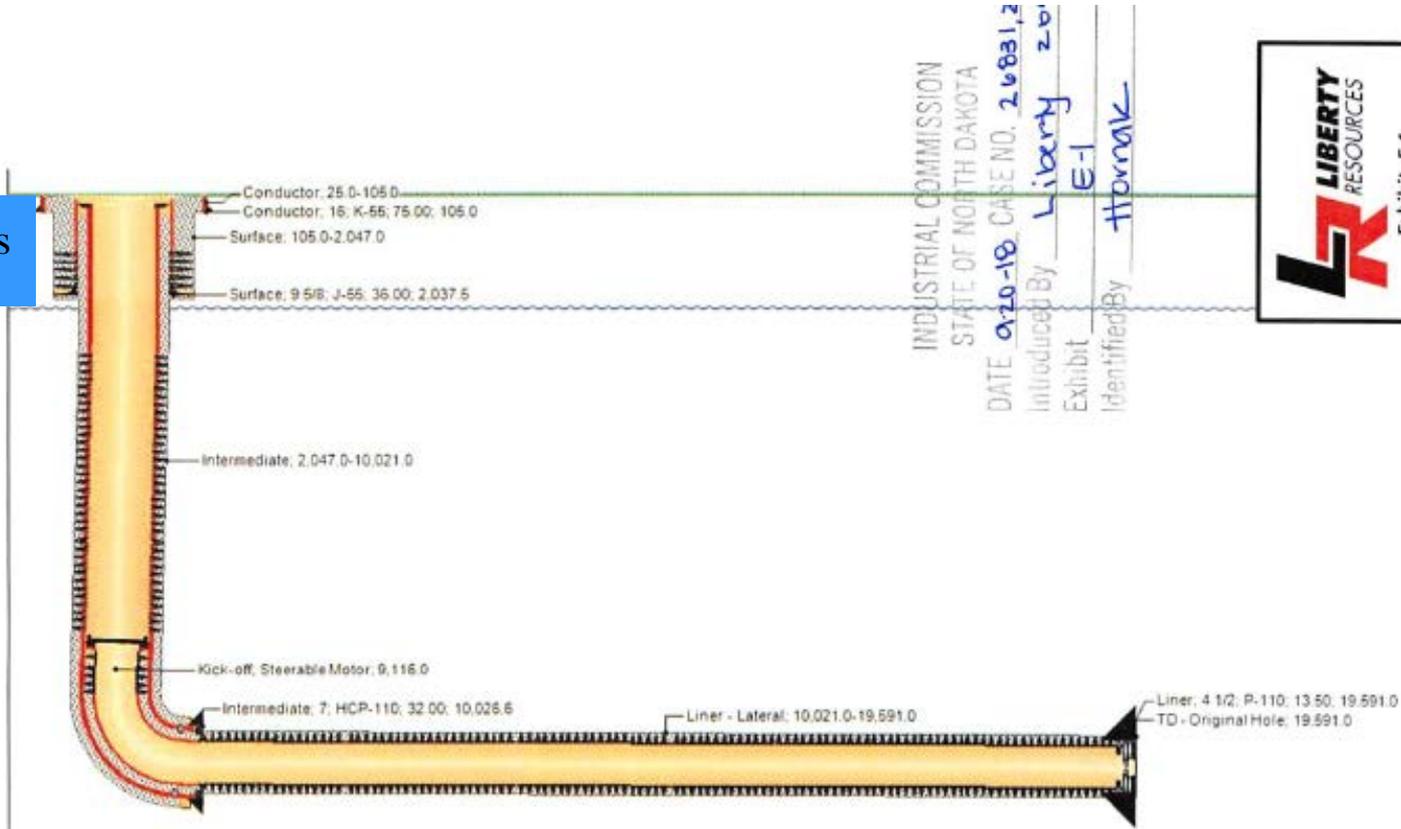
2009 – 2015 went from 28 to 50 stages

206 gallons slick water and 283 pounds sand per foot

# TYPICAL G4 HORIZONTAL OIL WELL

Potable Waters

Middle Bakken / Three Forks Type Well Dia



INDUSTRIAL COMMISSION  
 STATE OF NORTH DAKOTA  
 DATE 01-20-18 CASE NO. 26831.2  
 Introduced By Liberty  
 Exhibit E-1  
 Identified By Hornak



60-80 stages, 2-6 perf clusters per stage, diverters, coarse & very fine sand

1,112 gallons slick water and 977 pounds sand per foot vary with rock properties

# Marcellus Drilling News

Helping People & Businesses Profit from Northeast Shale Drilling



7th Annual

**OIL & GAS  
AWARDS**

Entry Deadline  
12/13/2014

Celebrate your  
HSE excellence  
with your staff  
and the market

## New Owner “Mothballs” GASFRAC’s Waterless LPG Technology

September 17, 2015 | Energy Services, GASFRAC, Hydraulic Fracturing, Industrywide Issues



In March MDN told you the sad story that Canadian waterless fracking company GASFRAC had been sold to an unnamed third party after going bankrupt (see Bankrupt Waterless Fracking Co GASFRAC Sold to “Third Party”). GASFRAC’s technology had been used

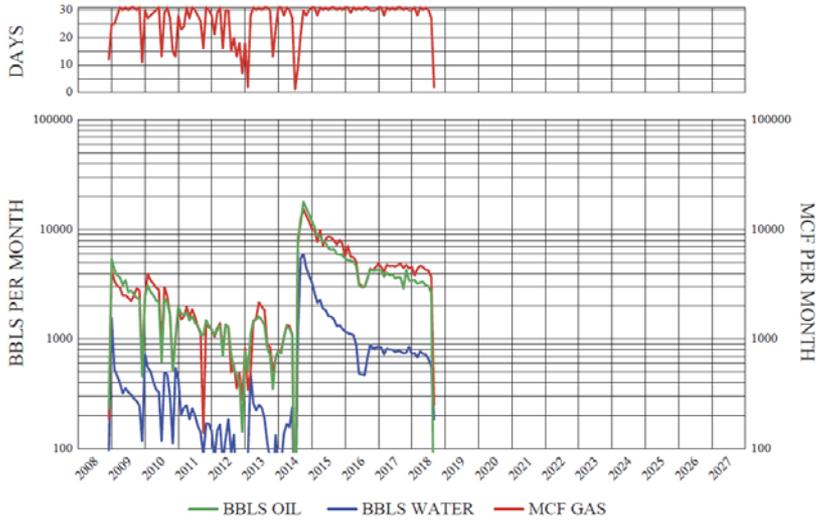
to frack a Utica Shale well (for \$22 million), and the results were, shall we say, less than stellar (see EPEP Reports Waterless Fracked OH Well is a Bust). We now know two new things about GASFRAC: (1) the company that purchased it out of bankruptcy is another Canadian company—STEP Energy; (2) STEP has mothballed GASFRAC’s waterless LPG fracking technology...

# G1 to G3 Re-Frac

#16686 33-061-00547-00-00 SESW 20-T151N-R93W  
 SHOBE 24-20H  
 MARATHON OIL COMPANY  
 REUNION BAY-BAKKEN

Page 1 of 1  
 12/26/2018

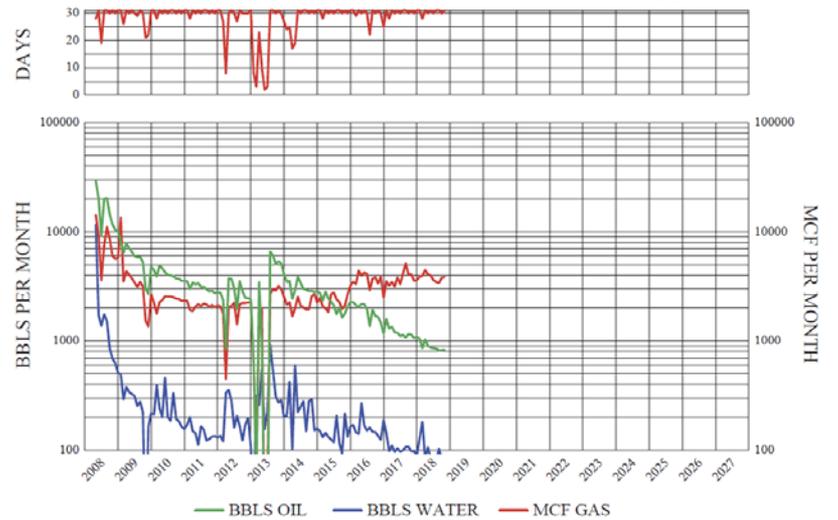
CUM OIL = 389493  
 CUM WATER = 85802  
 CUM GAS = 413887



#16667 33-061-00540-00-00 SESE 27-T153N-R90W  
 LOREN 1-27H  
 EOG RESOURCES, INC.  
 PARSHALL-BAKKEN

Page 1 of 1  
 12/26/2018

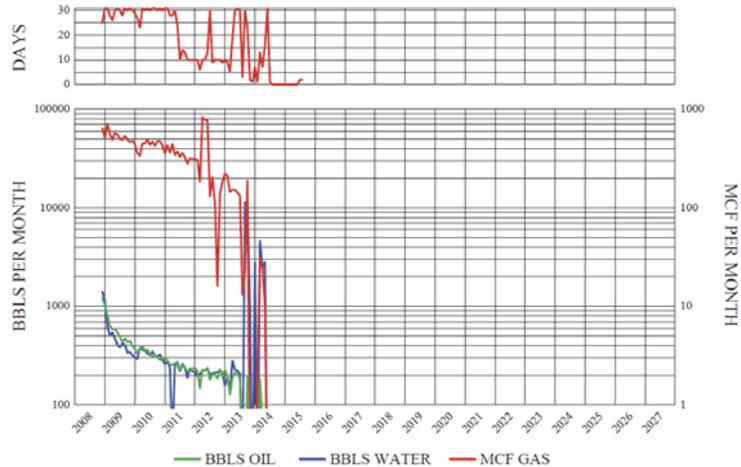
CUM OIL = 478155  
 CUM WATER = 44092  
 CUM GAS = 399000



#17232 33-007-01626-00-00 SWSE 4-T142N-R102W  
 ROOSEVELT FEDERAL 3-4H  
 LEGACY RESERVES OPERATING LP  
 ROOSEVELT-BAKKEN

Page 1 of 1  
 12/26/2018

CUM OIL = 19556  
 CUM WATER = 54346  
 CUM GAS = 21884

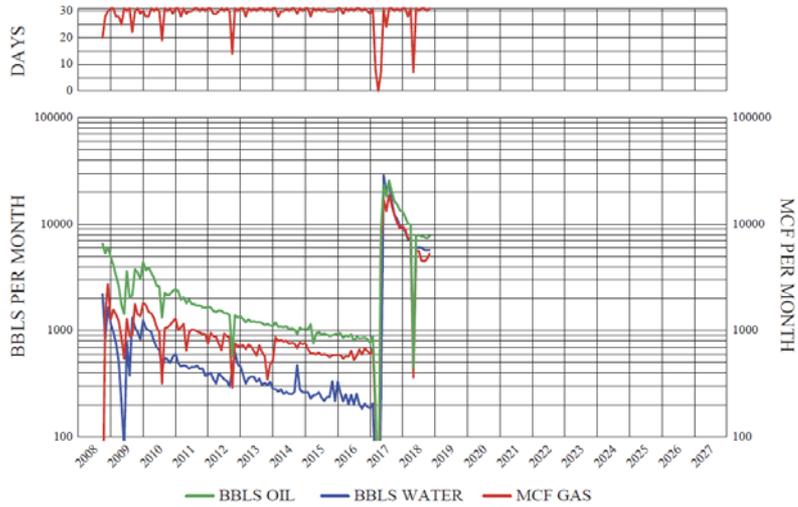


# G1-G2-G3 to G4 Re-Frac

#17255 33-025-00760-00-00 SESW 31-T146N-R93W  
 PELTON 24-31H  
 MARATHON OIL COMPANY  
 BAILEY-BAKKEN

Page 1 of 1  
 12/26/2018

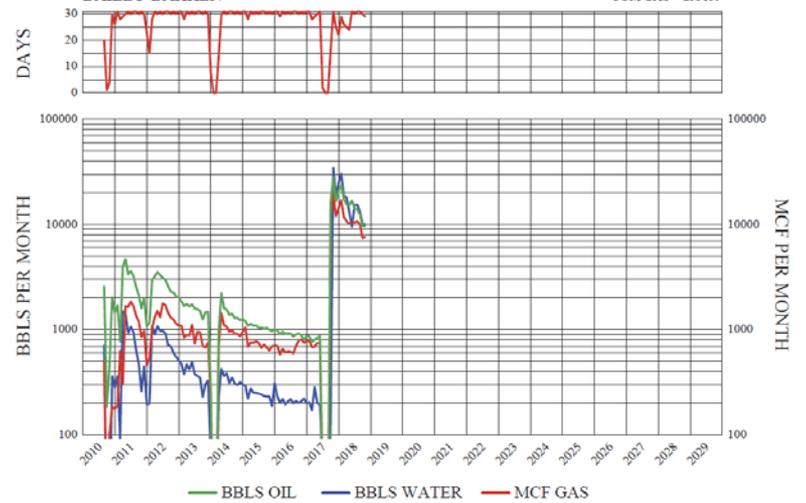
CUM OIL = 411935  
 CUM WATER = 239022  
 CUM GAS = 253105



#18842 33-025-01071-00-00 NWNW 27-T146N-R93W  
 TESCHER 11-27H  
 MARATHON OIL COMPANY  
 BAILEY-BAKKEN

Page 1 of 1  
 12/26/2018

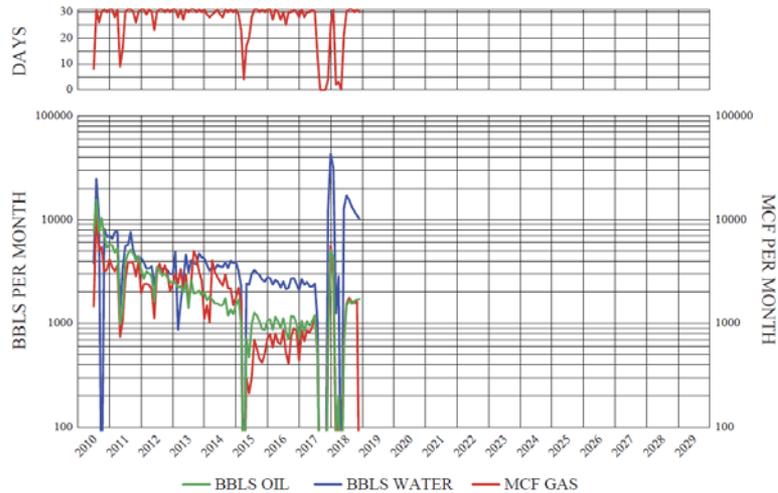
CUM OIL = 359020  
 CUM WATER = 265207  
 CUM GAS = 233159



#18791 33-105-01806-00-00 NENE 30-T154N-R103W  
 ABE 30-31 1-H  
 EQUINOR ENERGY LP  
 PAINTED WOODS-BAKKEN

Page 1 of 1  
 12/26/2018

CUM OIL = 235541  
 CUM WATER = 508655  
 CUM GAS = 202966



PRODUCING WELLS

ACTIVE DRILLING RIGS

**OIL & GAS PRODUCTION**

OIL PRICE

ENHANCED OIL RECOVERY

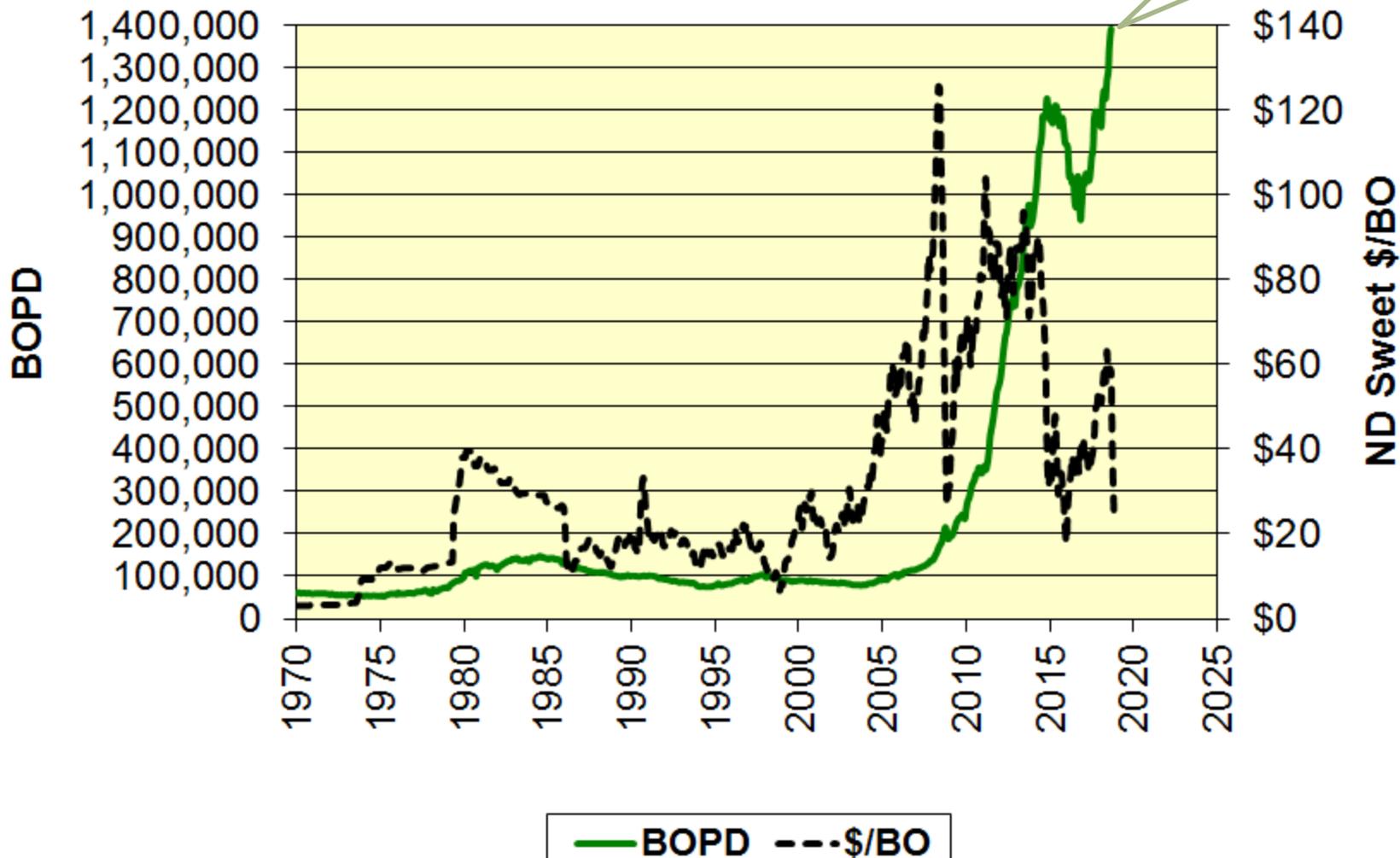
ACTIVITY FORECAST

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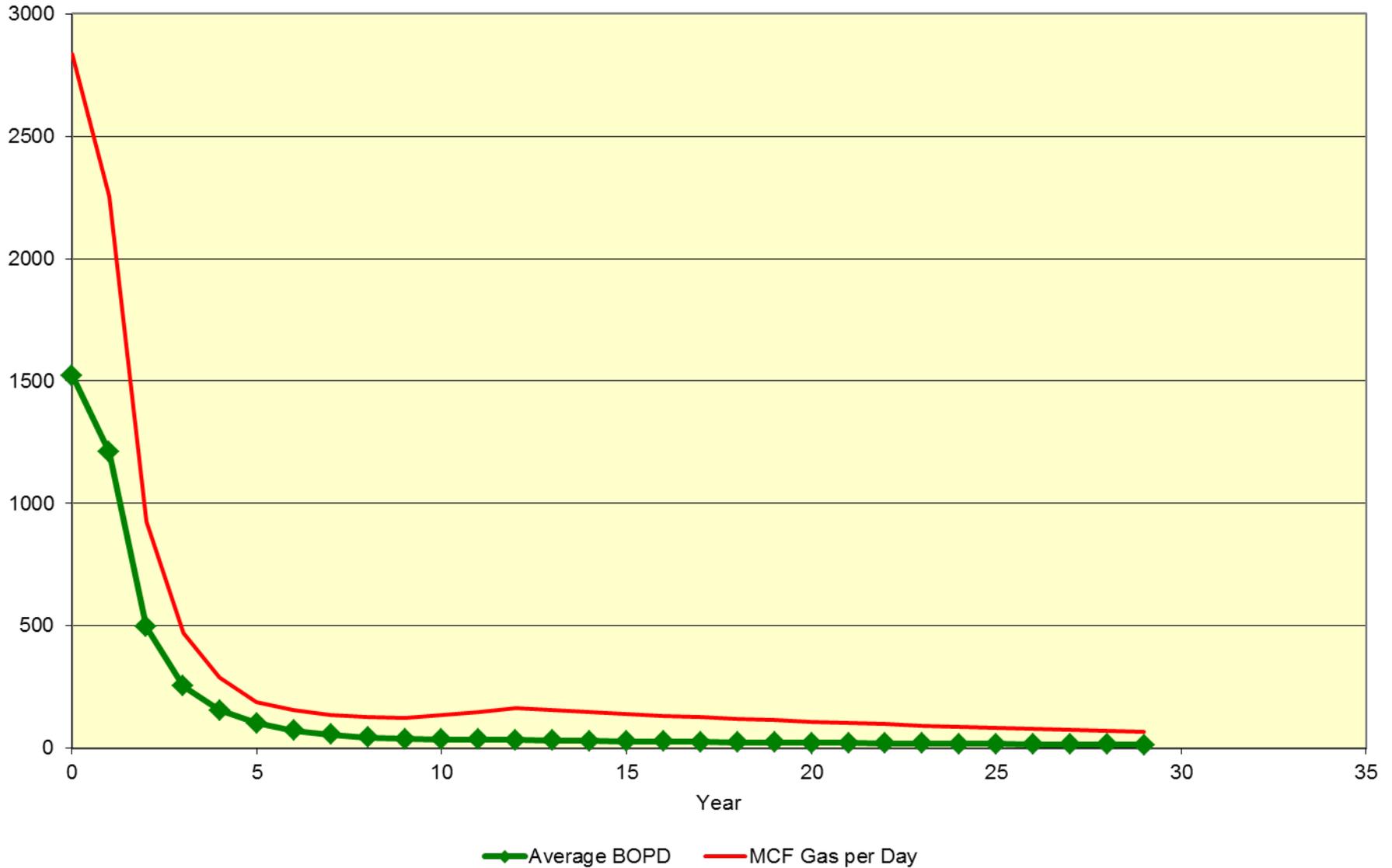
## North Dakota Daily Oil Produced and Price

**All-time high**  
**1,391,877**  
**barrels/day**  
October 2018



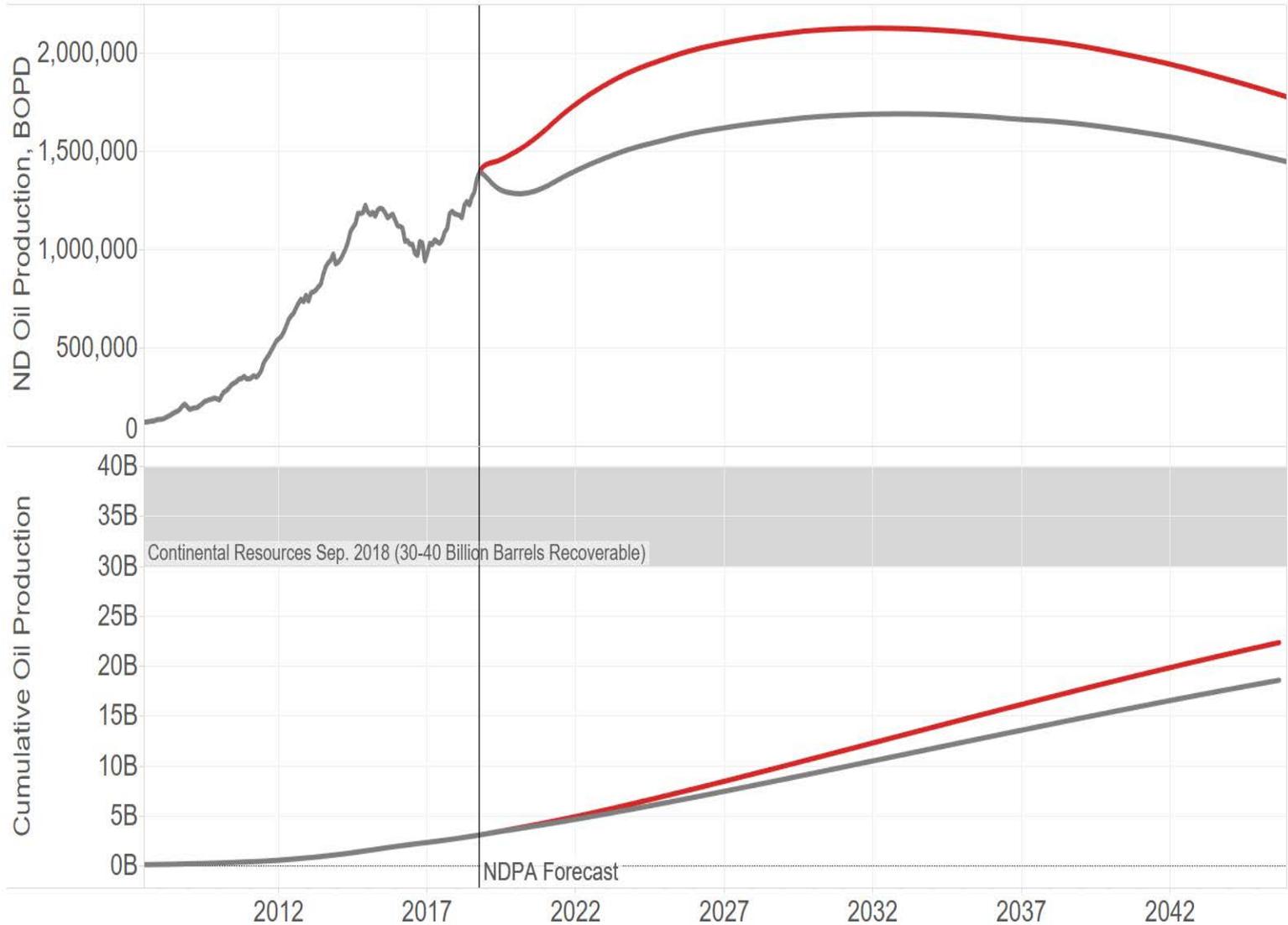
# Oil & Gas Production

Typical Bakken Well Production



# North Dakota Oil Production Forecast

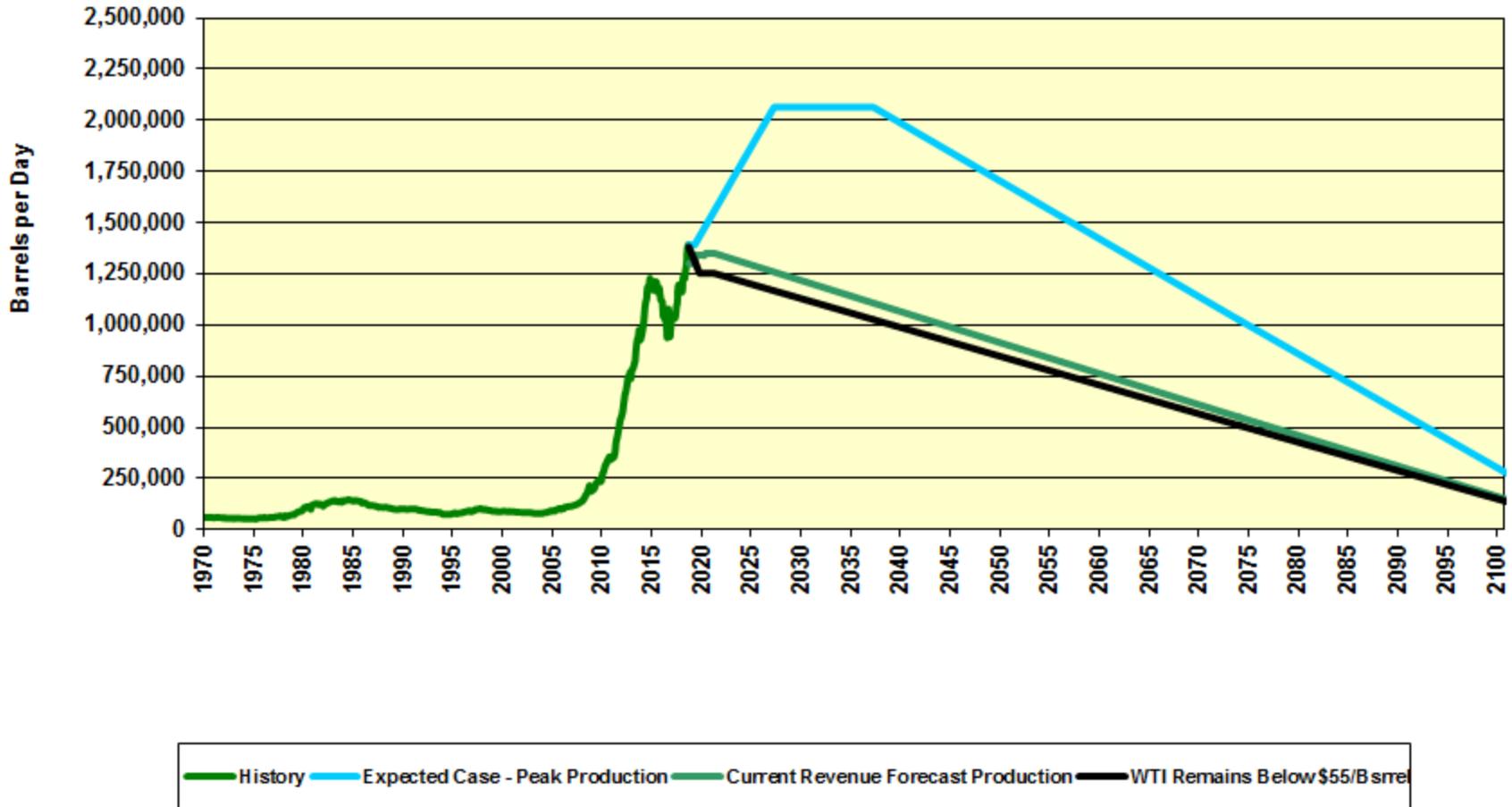
*Assumes Current Technology – Enhanced Oil Recovery Not Included*



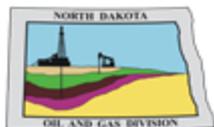
# Oil & Gas Production



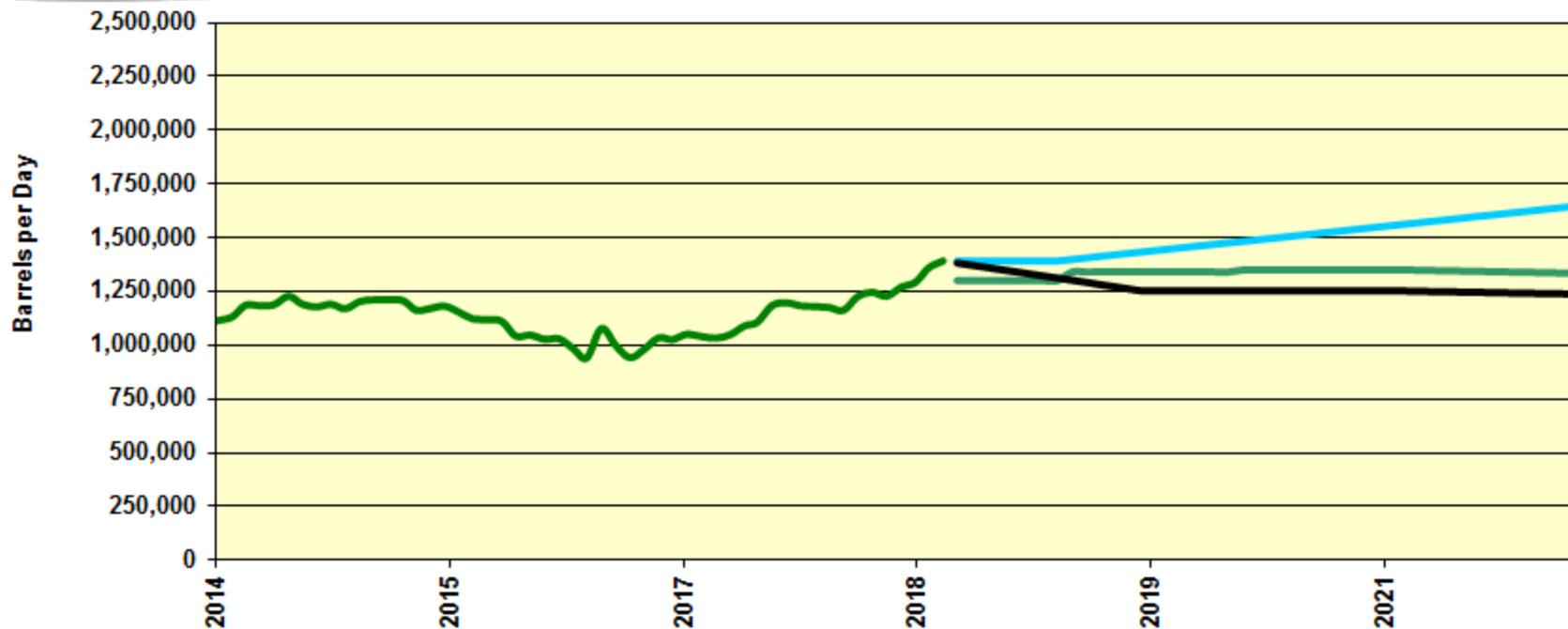
North Dakota Oil Production



# Oil & Gas Production



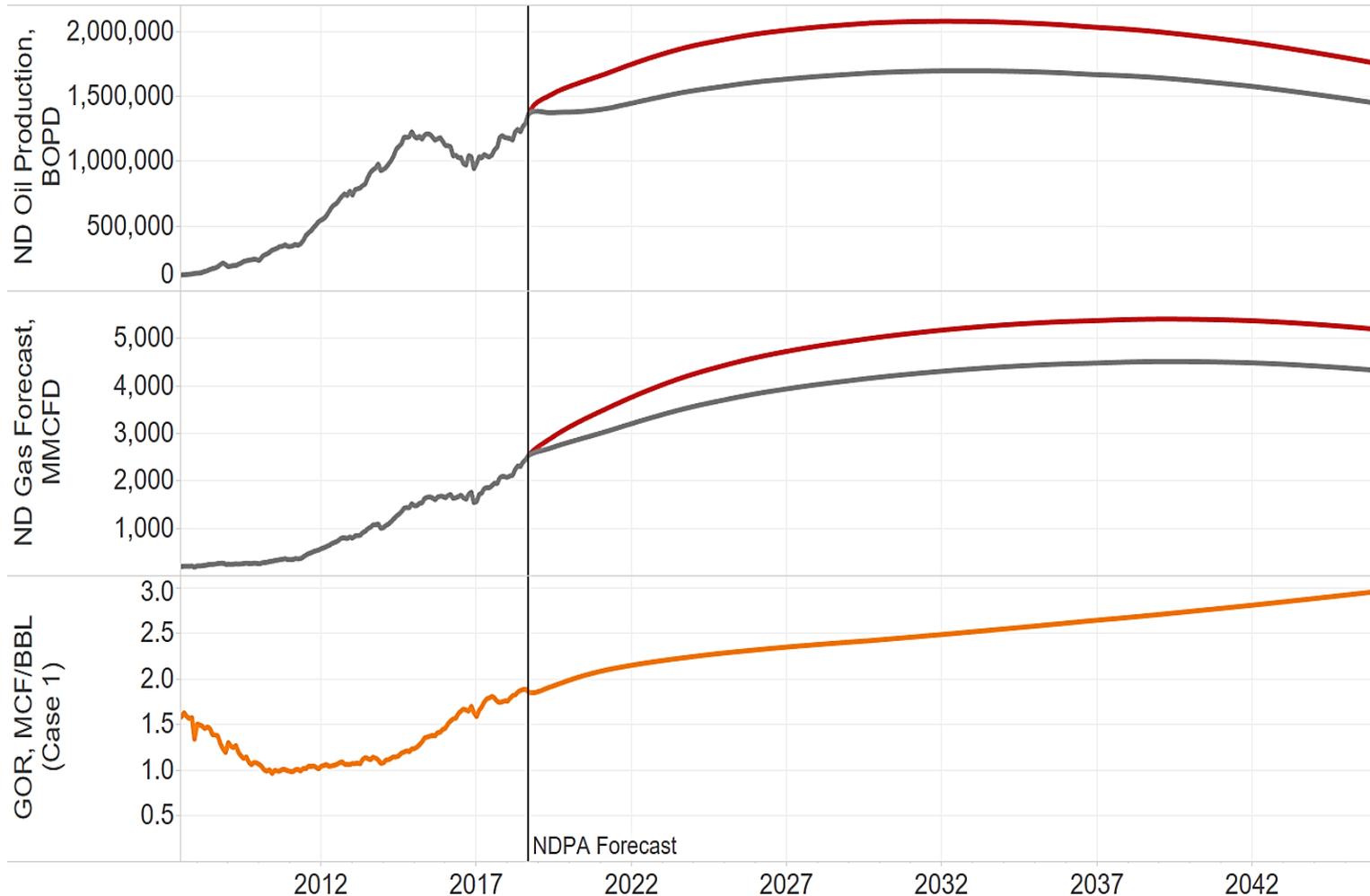
North Dakota Oil Production



History Expected Case - Peak Production Current Revenue Forecast WTI Remains Below \$55/Bsrel

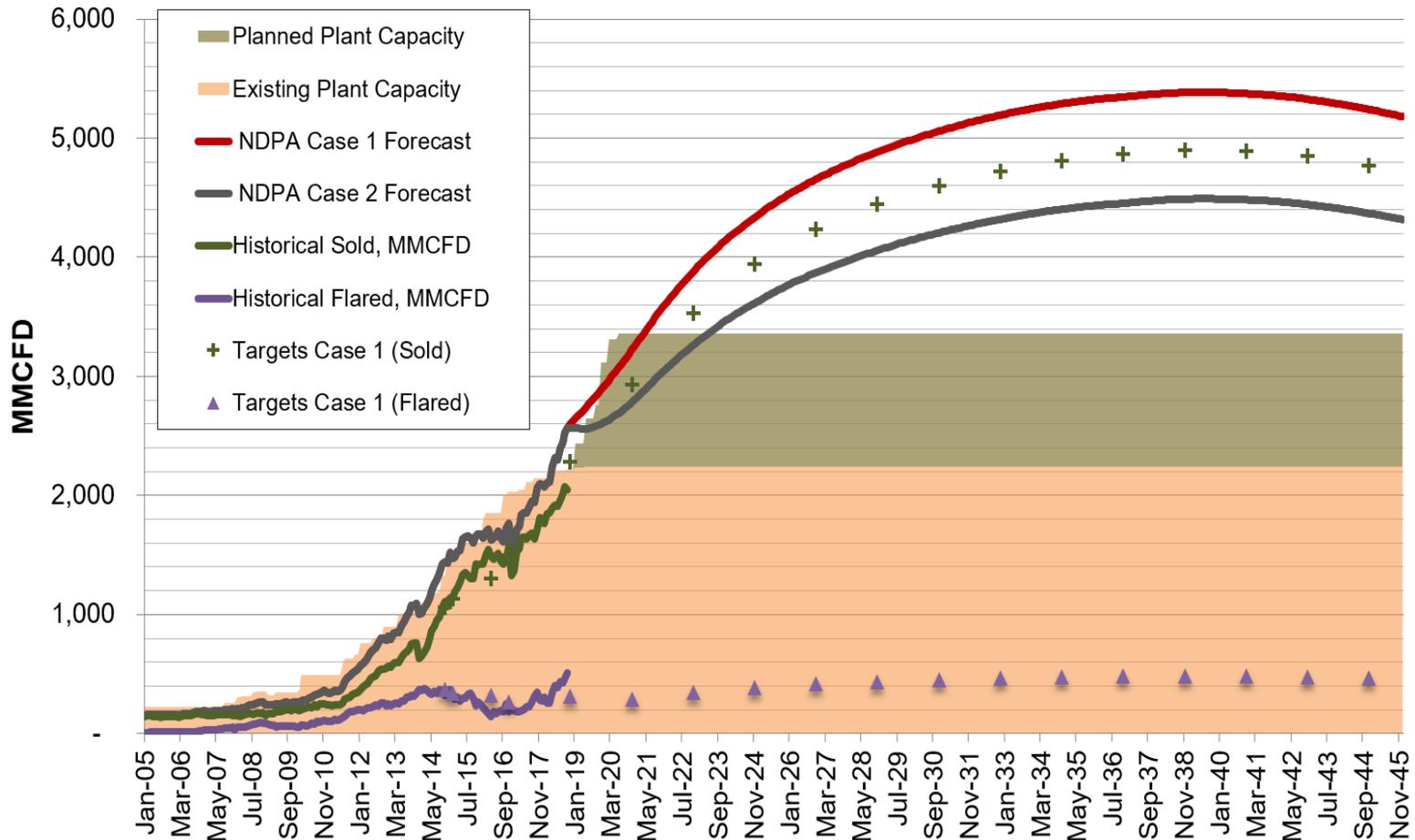
# NDPA North Dakota Production Forecast Summary

*Assumes Current Technology – Enhanced Oil Recovery Not Included*



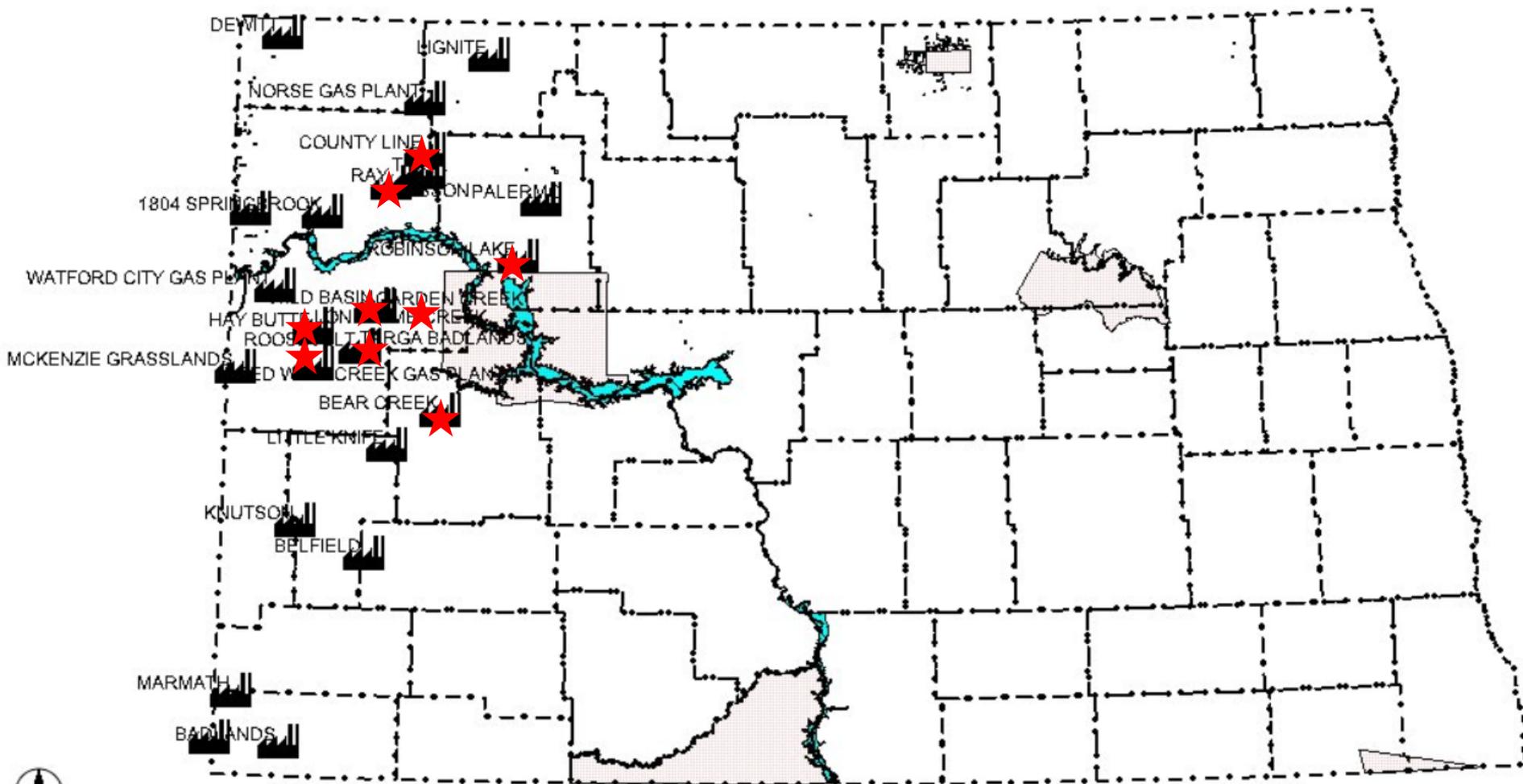
# Solving the Flaring Challenge

*Assumes Current Technology – Enhanced Oil Recovery Not Included*



# Gas Processing Plants

2.14 BCFD in 2017 > 3.36 BCFD in 2020



PRODUCING WELLS

ACTIVE DRILLING RIGS

OIL & GAS PRODUCTION

**OIL PRICE**

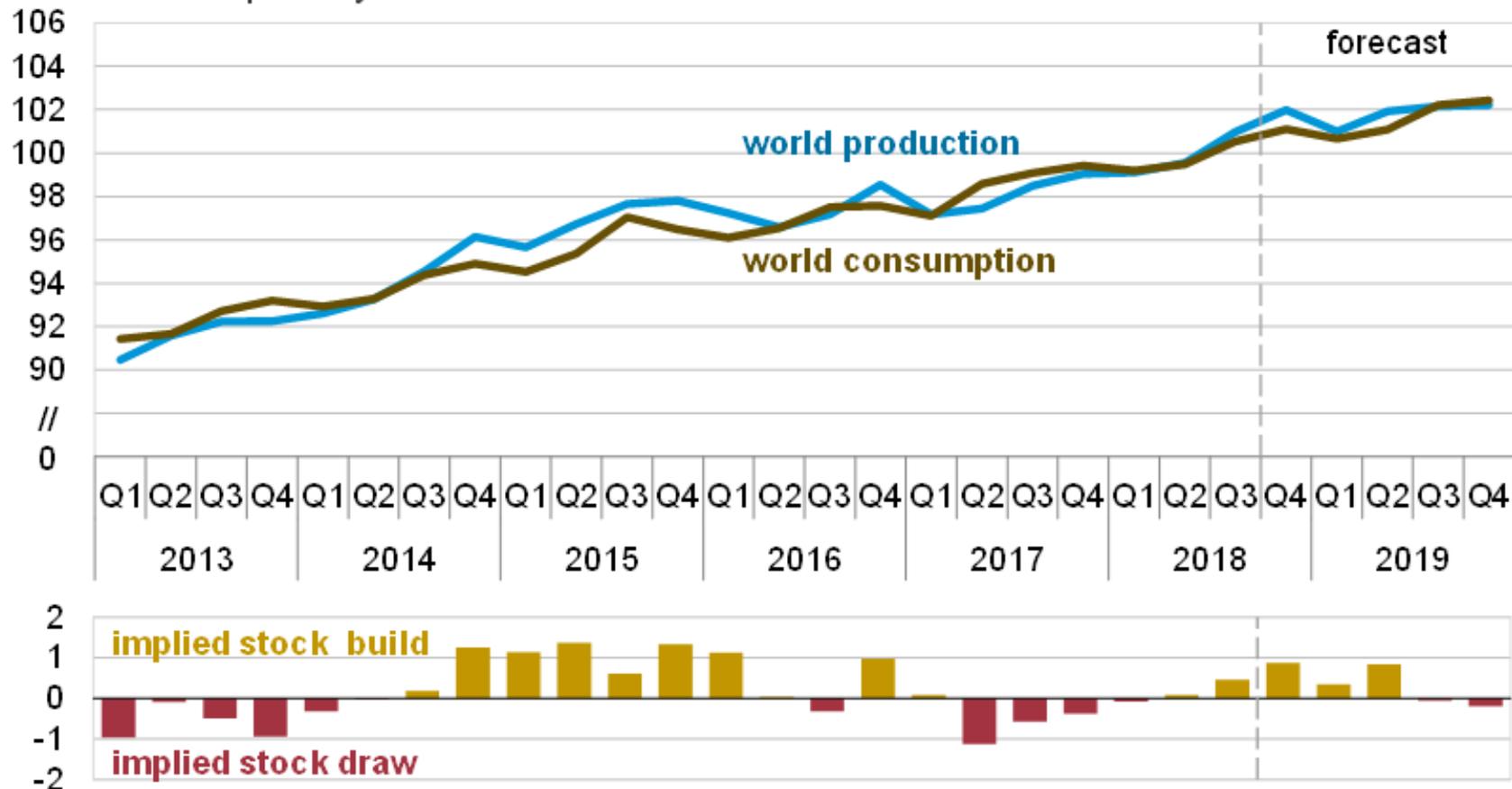
ENHANCED OIL RECOVERY

ACTIVITY FORECAST

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## World liquid fuels production and consumption balance

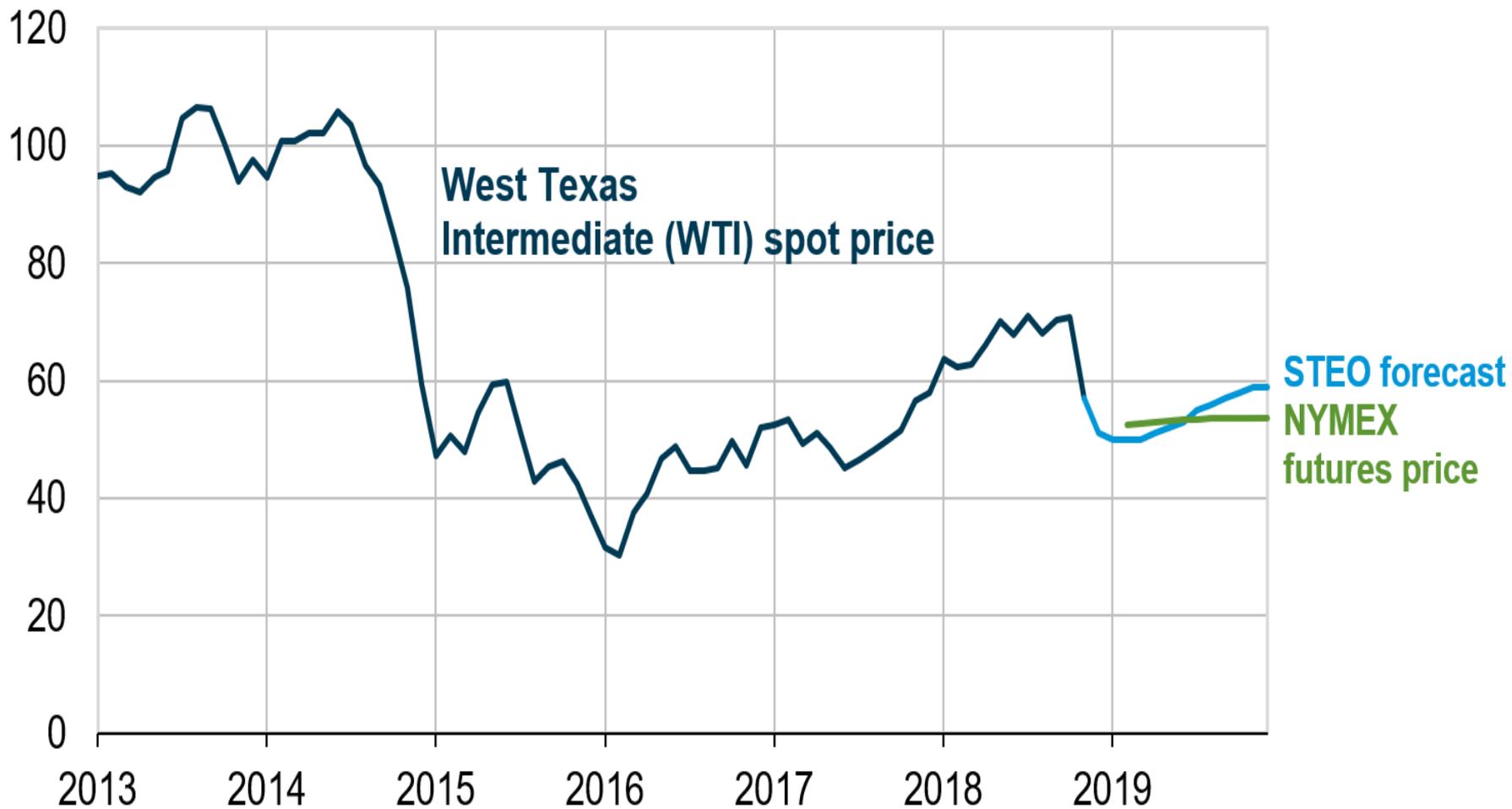
million barrels per day



Source: Short-Term Energy Outlook, December 2018

# West Texas Intermediate (WTI) crude oil price

dollars per barrel



Source: Short-Term Energy Outlook, December 2018, and CME Group





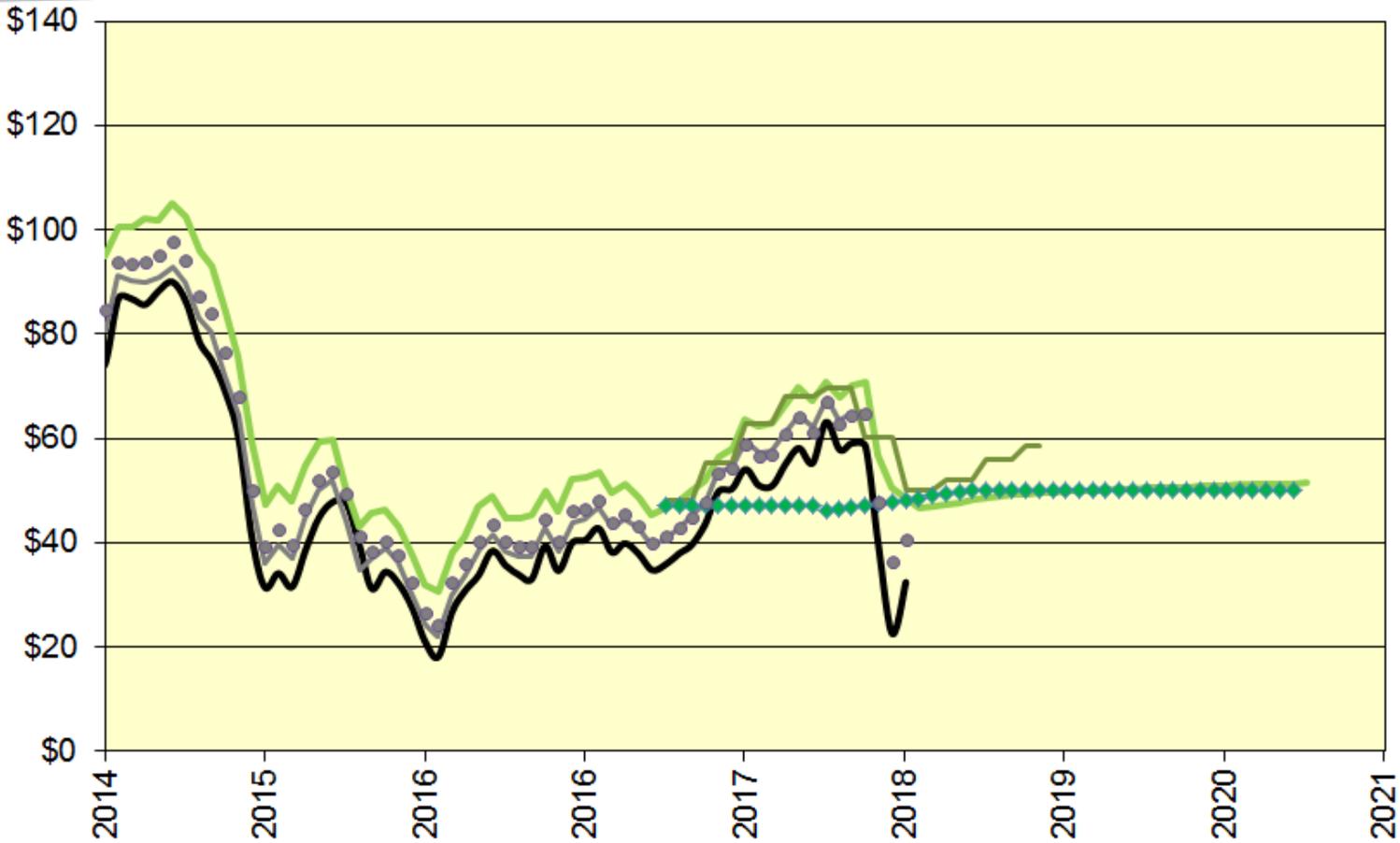
## North Dakota Oil Price



— \$/Barrel ND Sweet History   • Revenue Forecast   — \$/Barrel WTI   — ND Actual Tax Dept   • Avg NDSweet & WTI   — EIA - STEO



# North Dakota Oil Price



— \$/Barrel ND Sweet History   ♦ Revenue Forecast   — \$/Barrel WTI   — ND Actual Tax Dept   • Avg NDSweet & WTI   — EIA - STEO

PRODUCING WELLS

ACTIVE DRILLING RIGS

OIL & GAS PRODUCTION

OIL PRICE

**ENHANCED OIL RECOVERY**

ACTIVITY FORECAST

---

# Enhanced Oil Recovery (EOR)<sup>1</sup>

- EOG is the 1<sup>st</sup> company to say it has significantly increased oil production from an unconventional play using gas injection.
- Field tests since program started in 2013:
  - The production increases on 15 wells indicated from 30-70% reserve gains.
  - A 32-well test in 2016 added 300,000 bbl of oil at \$6/bbl finding cost.
  - Work is ongoing on 100 wells in six areas in 2017.

# Enhanced Oil Recovery (EOR)<sup>1</sup>

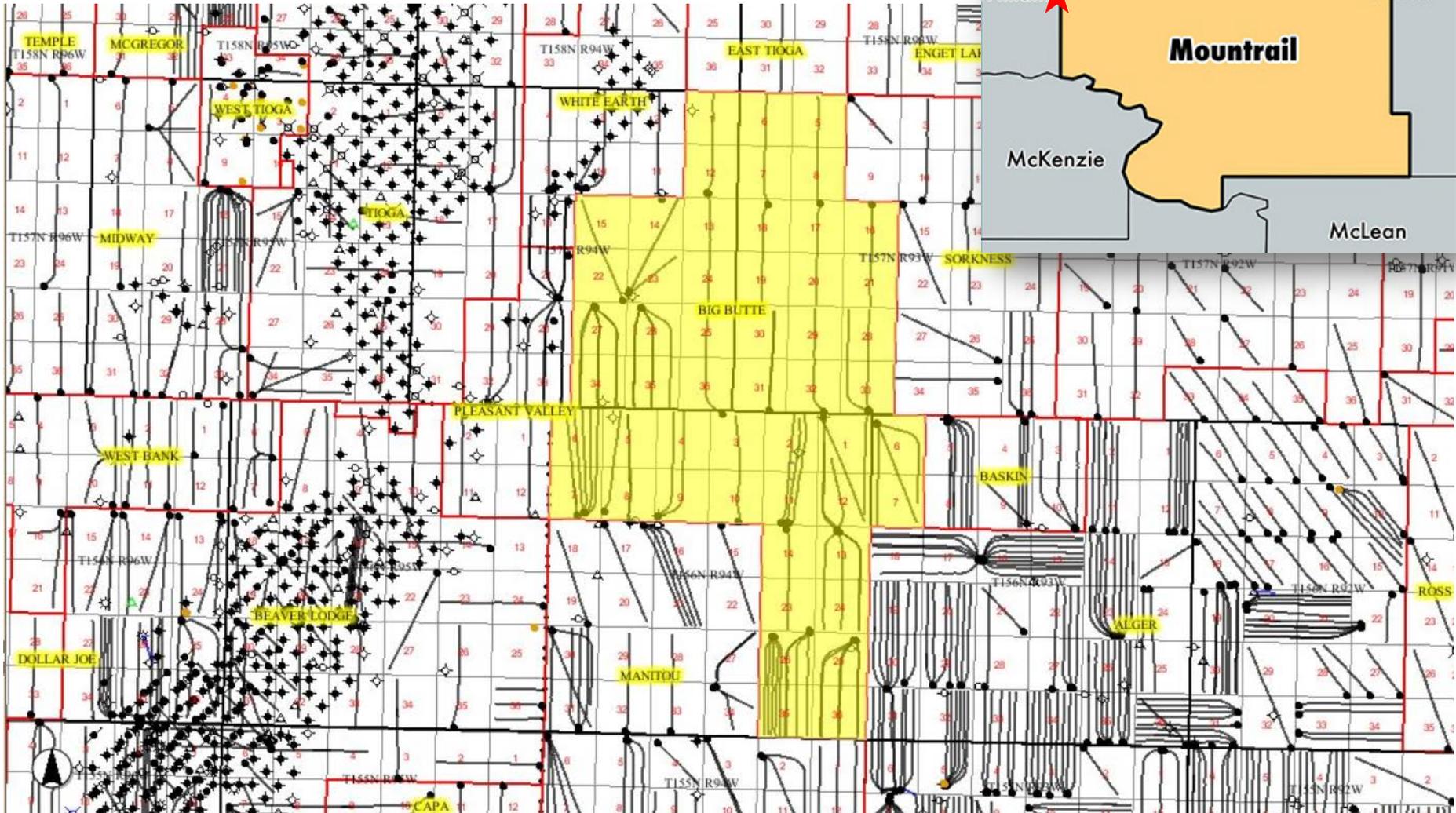
## Inputs and Outputs

- Additional capital costs average about \$1 million per well
- The process uses associated gas from its wells
- Production response is in 2-3 months
- \$1 invested adds \$2 to net present value

## It Works if:

- The formation is able to contain high-pressure gas injection near the well.
- Wellbores contact the most productive rock.
- The completion maximizes the fractured area within a restricted zone around the wellbore.

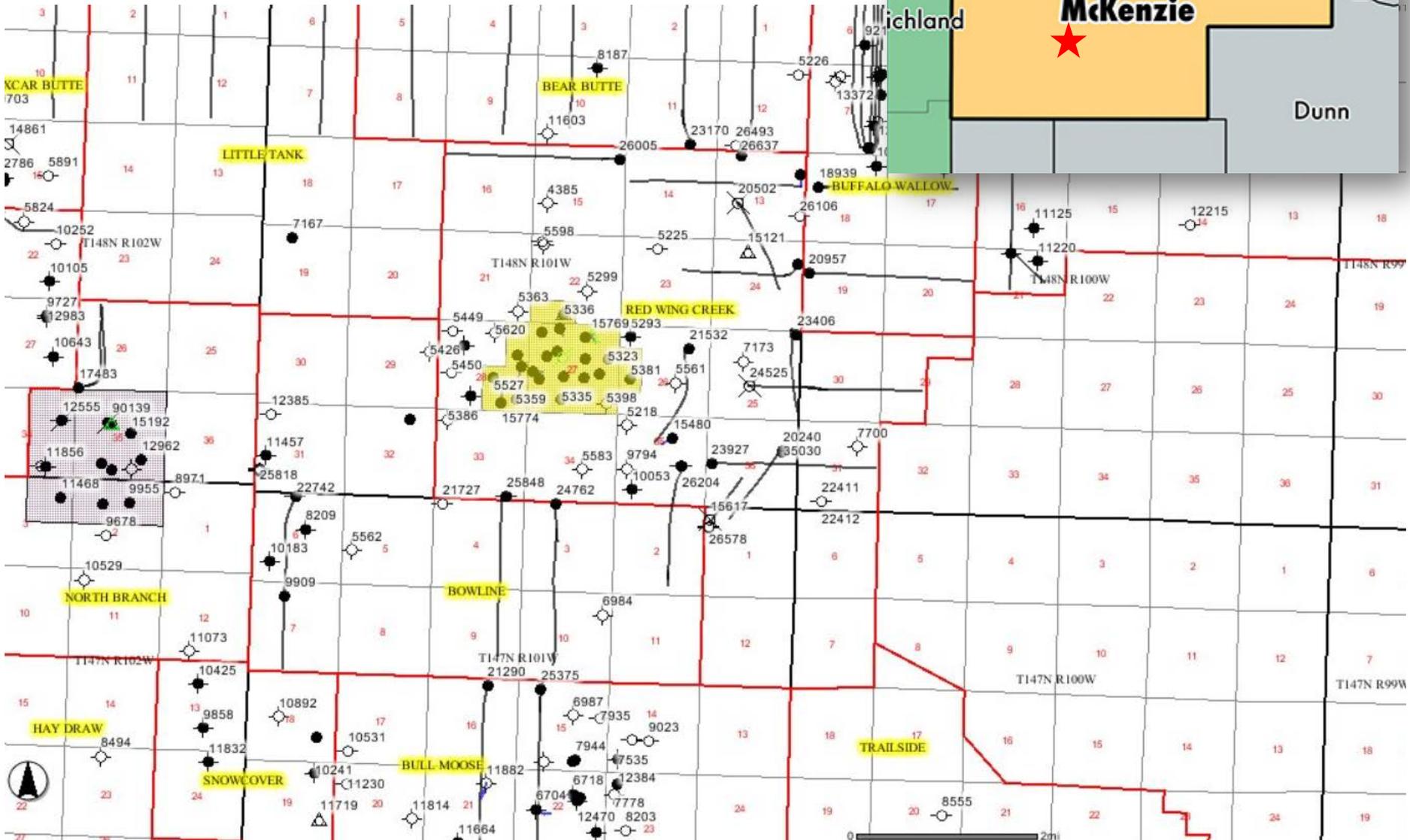
# Big Butte



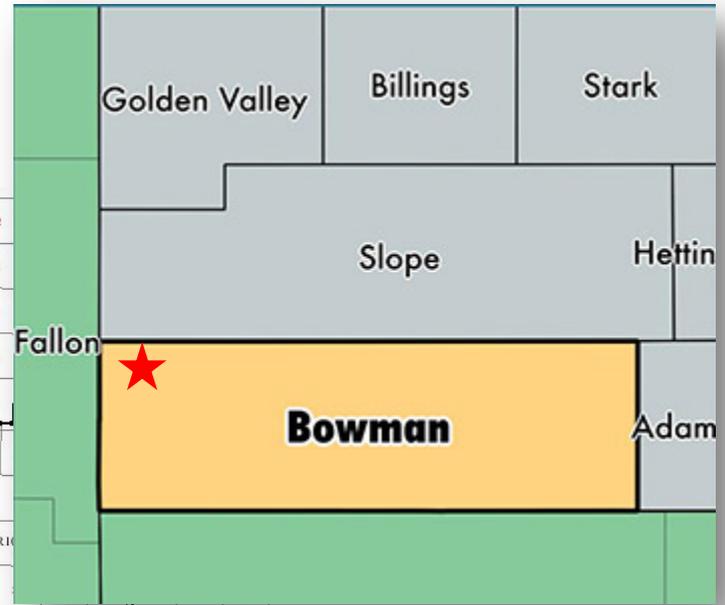
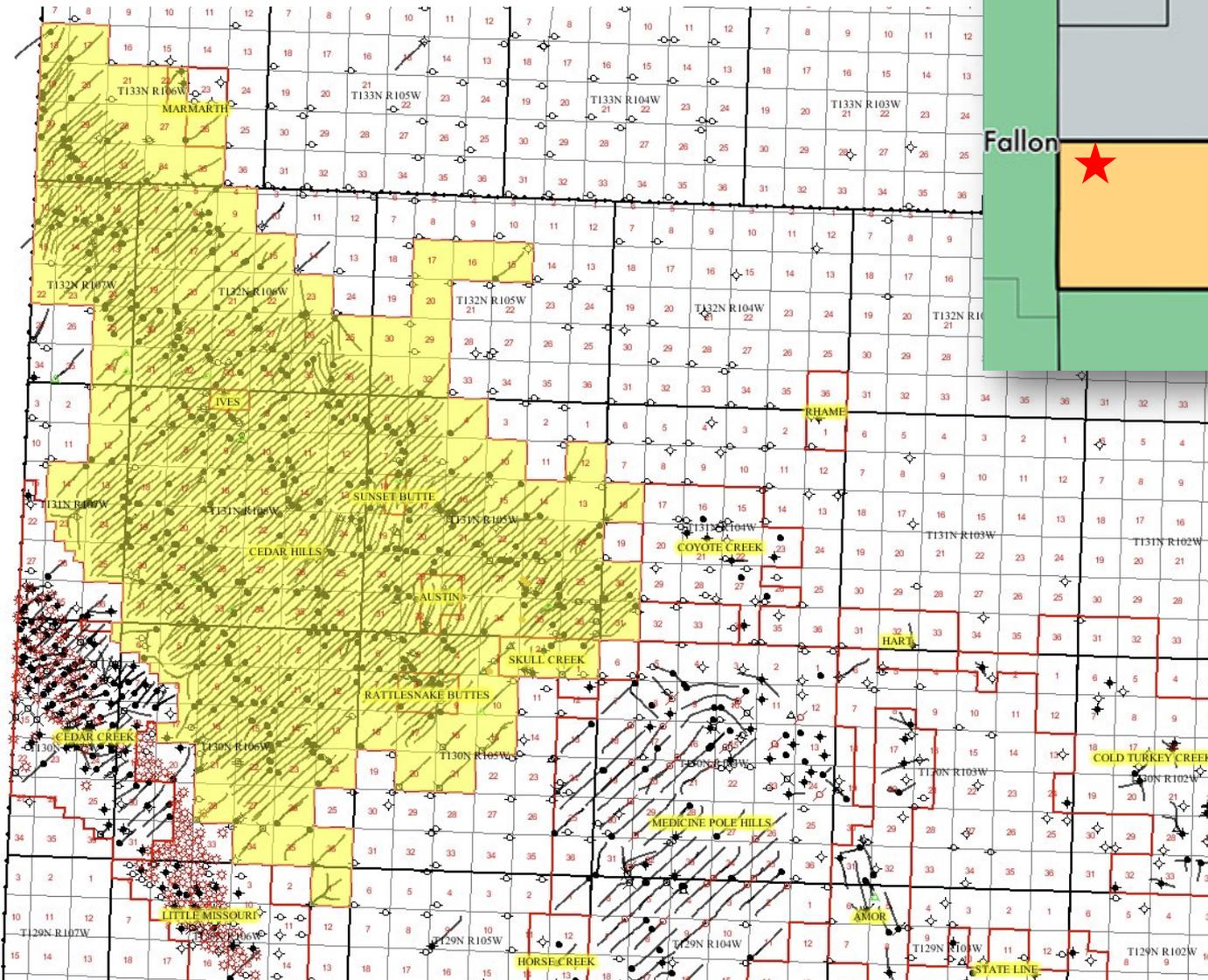




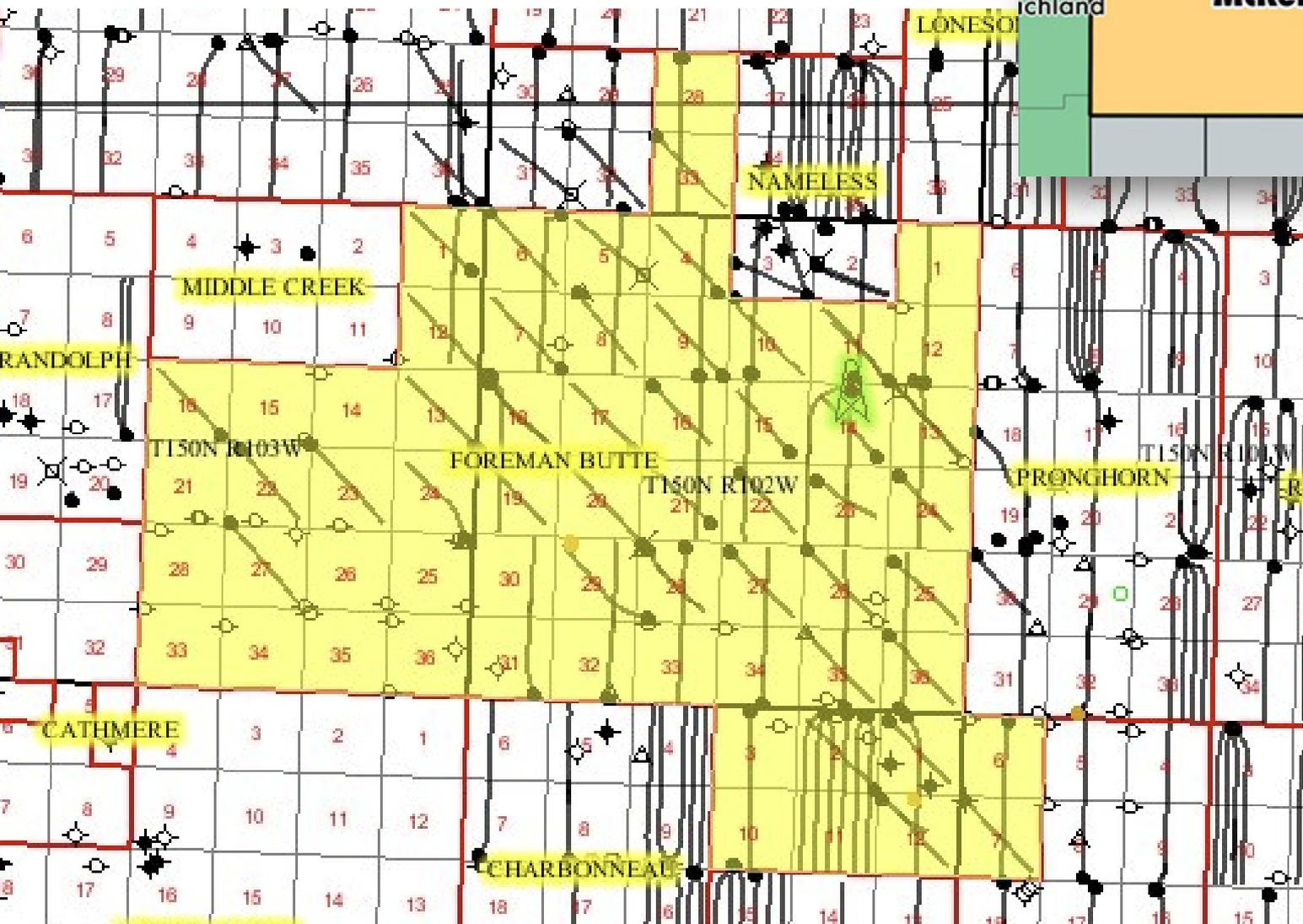
# Red Wing Creek



# Cedar Hills



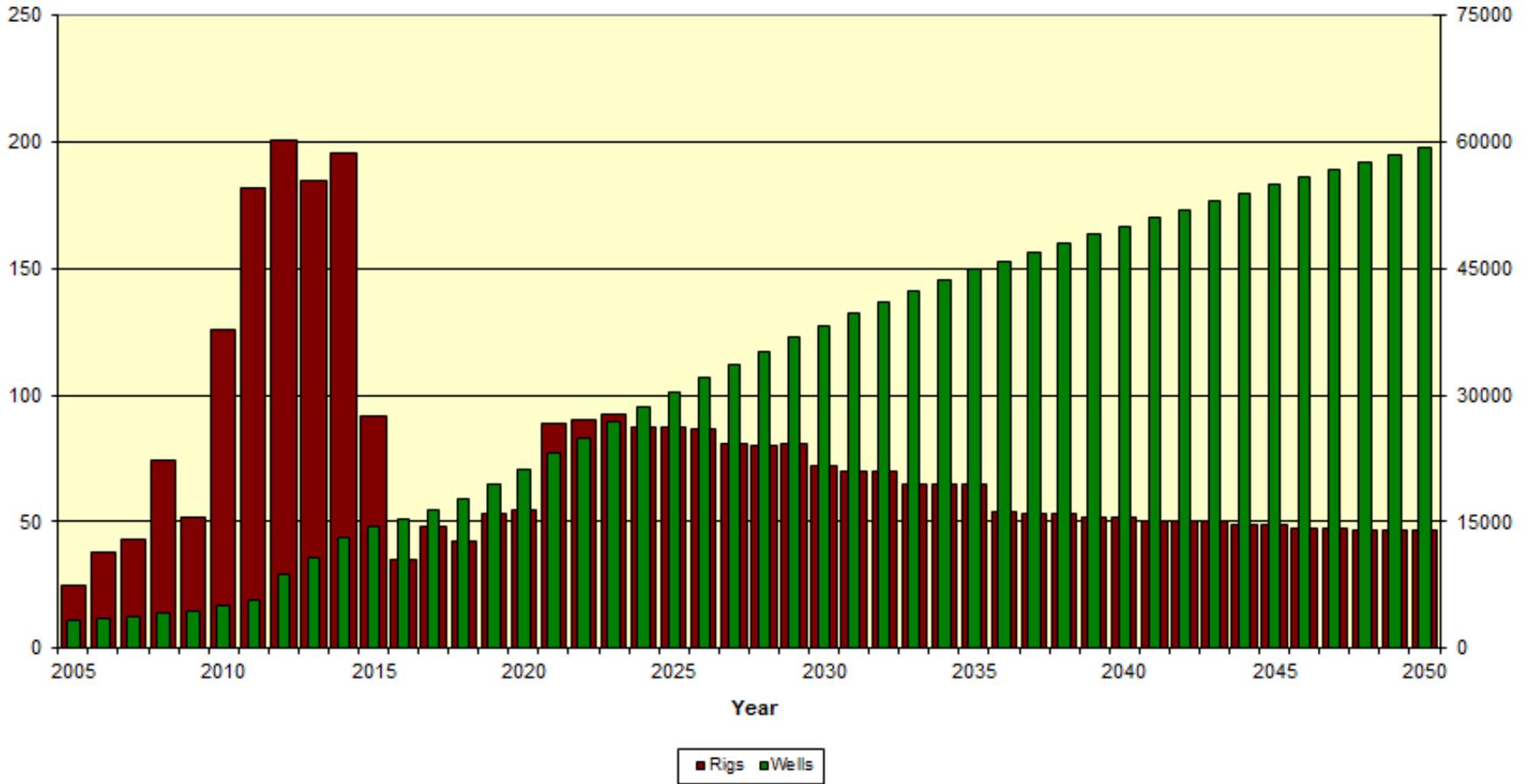
# Foreman Butte



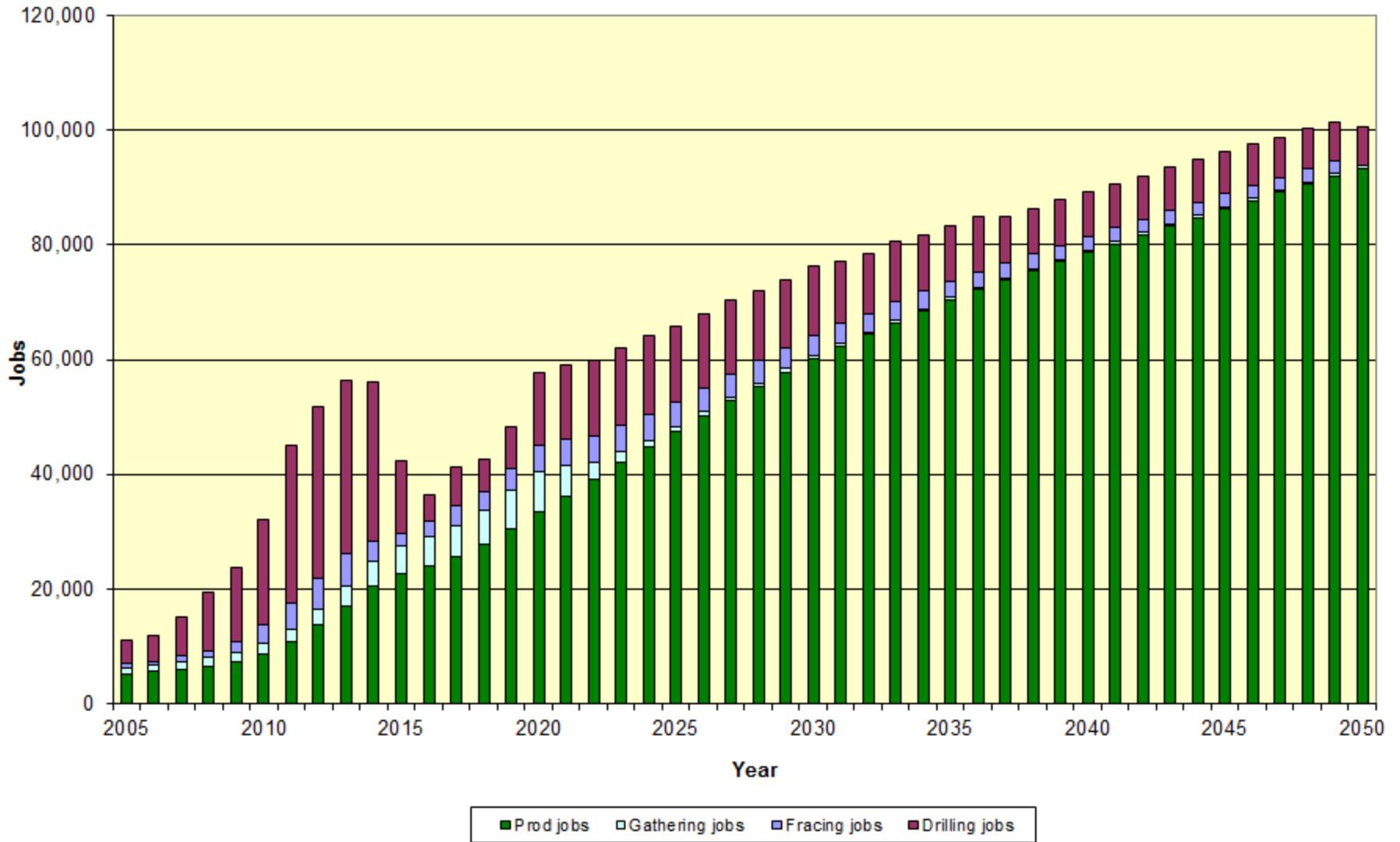
PRODUCING WELLS  
ACTIVE DRILLING RIGS  
OIL & GAS PRODUCTION  
OIL PRICE  
ENHANCED OIL RECOVERY  
**ACTIVITY FORECAST**

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### North Dakota Rigs and Wells



# North Dakota Oil Industry Jobs



# Abandoned Well Plugging and Site Restoration

- Current fund balance \$21 million
  - Plugging and Reclamation
    - 438 Total North Dakota wells plugged and reclaimed 2017-2019 biennium \$32.3 million
    - 5 wells plugged and reclaimed by AWPSRF fund \$369,000
    - Anticipate the same for 2019-2021 biennium
  - Legacy sites
    - \$3.331 million reclamation 2017-2019 biennium
    - \$100,000 anticipated 2019-2021 biennium
  - Brine Ponds
    - \$980,000 research 2017-2019 biennium
    - \$200,000 pilot project 2019-2021 biennium
- 2018 bankruptcy case
  - \$2 million in bonds
  - 590 wells
    - 384 active, 116 abandoned, 51 inactive, 25 temp abandoned, 14 undrilled locations
    - \$23 million liabilities
    - \$39 million assets

**NORTH DAKOTA  
DEPARTMENT OF MINERAL RESOURCES**

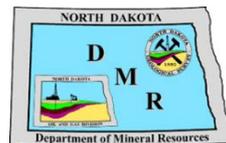
# CONTACT US

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Bismarck, ND 58505**

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**Email: [oilandgasinfo@nd.gov](mailto:oilandgasinfo@nd.gov)**



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