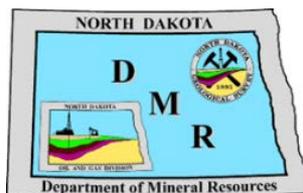


**NORTH DAKOTA
DEPARTMENT OF MINERAL RESOURCES:**
OIL & GAS UPDATE

January 21 2021 | House Energy and natural Resources



Visit Us: www.dmr.nd.gov

RECENT EVENTS

CURRENT ACTIVITY

WELLS – RIGS – JOBS – PRODUCTION

NEXT BIENNIUM 2021-2023

PRICES – PRODUCTION – JOBS

INNOVATION

RECENT EVENTS

CURRENT ACTIVITY

WELLS – RIGS – JOBS – PRODUCTION

NEXT BIENNIUM 2021-2023

PRICES – PRODUCTION – JOBS

INNOVATION

What Is a Black Swan?

A black swan is an unpredictable event
beyond what is normally expected of a situation
has potentially severe consequences
extremely rare
severe impact
widespread insistence they were obvious in hindsight.



COVID19



November Elections



OPEC +



DAPL



Norther Border

MOSCOW (Bloomberg) --Russia plans to support a further gradual increase in OPEC+ production at the next meeting in January, because crude prices are within an optimal range. **“To restore our output, that we’ve reduced a lot, the price range of \$45 to \$55 a barrel is the most optimal,” Deputy Prime Minister Alexander Novak told reporters in Moscow. “Otherwise, we’ll never restore production, others will restore it.”**

The 13th OPEC and non-OPEC Ministerial Meeting (ONOMM), concluded on 5 January 2021.

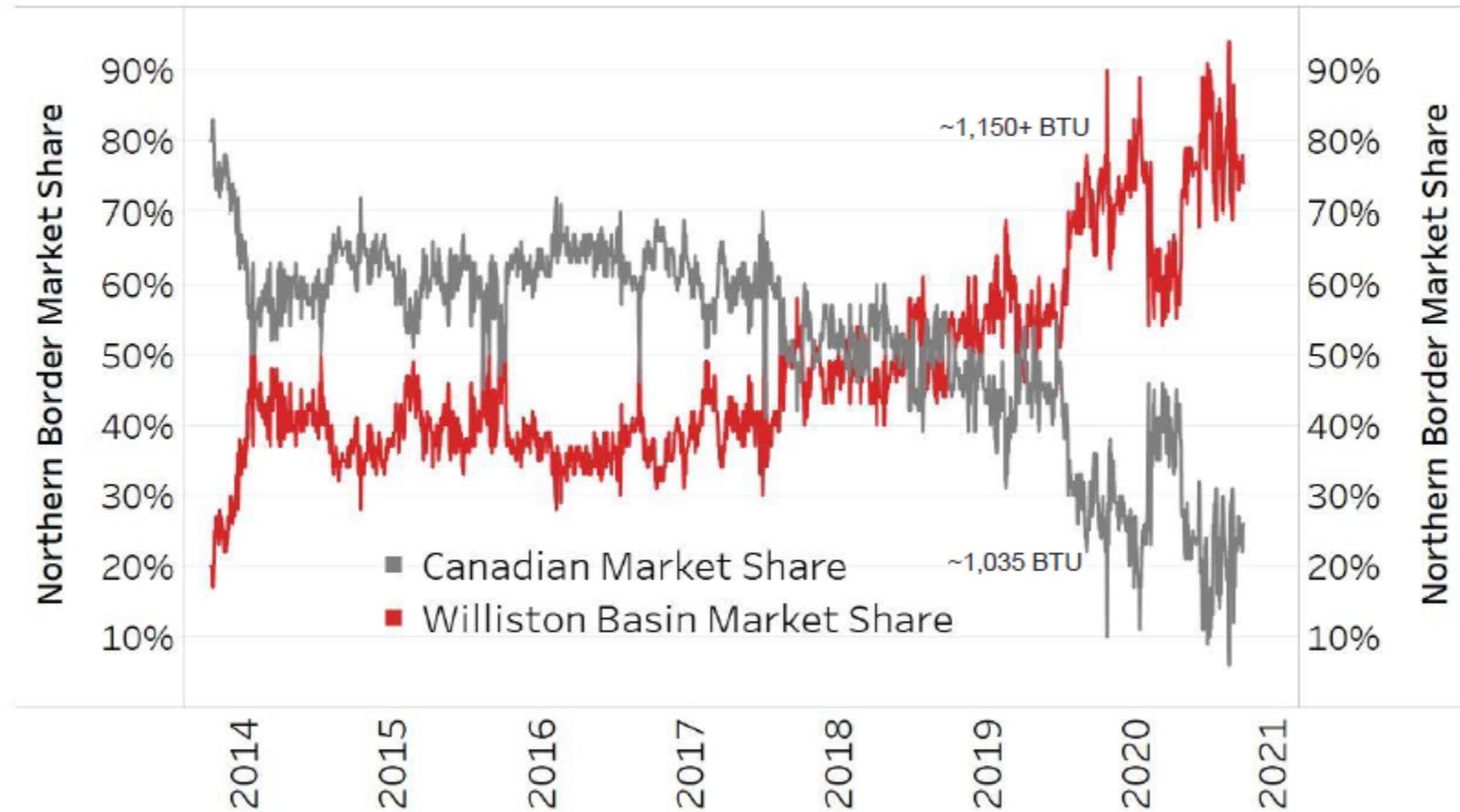
The Meeting reaffirmed the continued commitment of the participating countries in the Declaration of Cooperation (DoC) to a stable market in the mutual interest of producing nations; the efficient, economic and secure supply to consumers; and a fair return on invested capital.

The Meeting acknowledged the need to gradually return 2 mb/d to the market, with the pace being determined according to market conditions. It reconfirmed the decision made at the 12th ONOMM to increase production by 0.5 mb/d starting in January 2021, and adjusting production reduction from 7.7 mb/d to 7.2 mb/d. Saudi Arabia will make additional, voluntary oil output cuts of 1 million bbl/d in February and March as part of a deal under which most OPEC+ producers will hold production steady in the face of new coronavirus lockdowns. Most members will hold output steady next month. Two producers - Russia and Kazakhstan - will be allowed to bump up their output by a combined 75,000 bbl/d in February and a further 75,000 bbl/d in March,

Production adjustments for April and subsequent months will be decided during the monthly ONOM. Between May and November, participating OPEC and non-OPEC countries contributed to reducing the global supply by approximately 1.9 billion barrels, and this has been key to the rebalancing of the market.

The Meeting decided to hold the next Joint Ministerial Monitoring Committee (JMMC) Meeting on 3 February 2021, followed by a JMMC Meeting on 3 March 2021 and ONOMM on 4 March 2021.

Northern Border Pipeline Market Share



Biden administration appointments

Secretary of State

Antony Blinken

Attorney General

Merrick Garland

Energy Secretary

Jennifer Granholm

Interior Secretary

Deb Haaland

Agriculture Secretary

Tom Vilsack

Transportation Secretary

Pete Buttigieg

UN Ambassador

Linda Thomas-Greenfield

Director of Office of Management and Budget

Neera Tanden

EPA Administrator

Michael Regan

U.S. Trade Representative

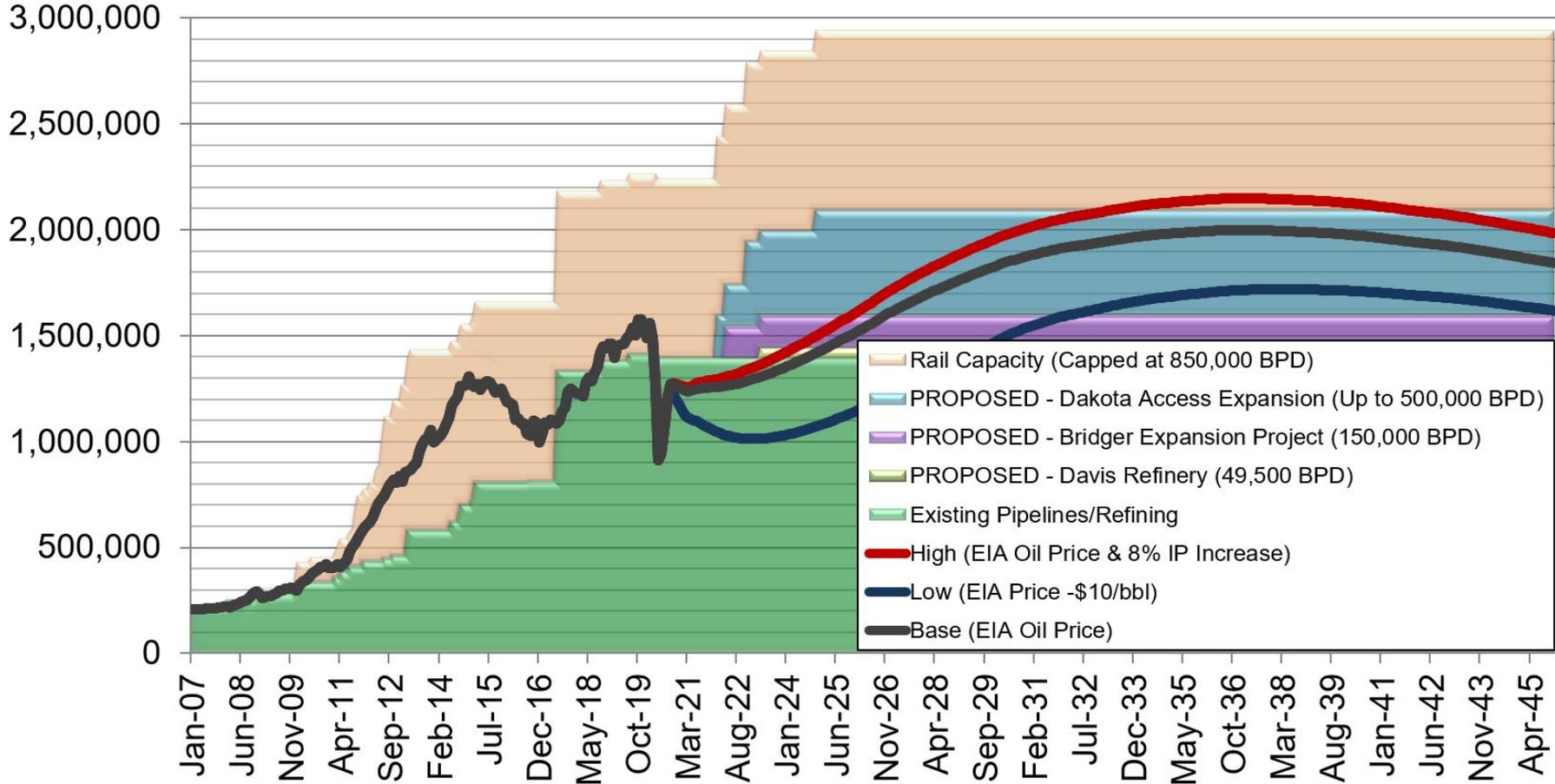
Katherine Tai

Special Envoy for Climate

John Kerry

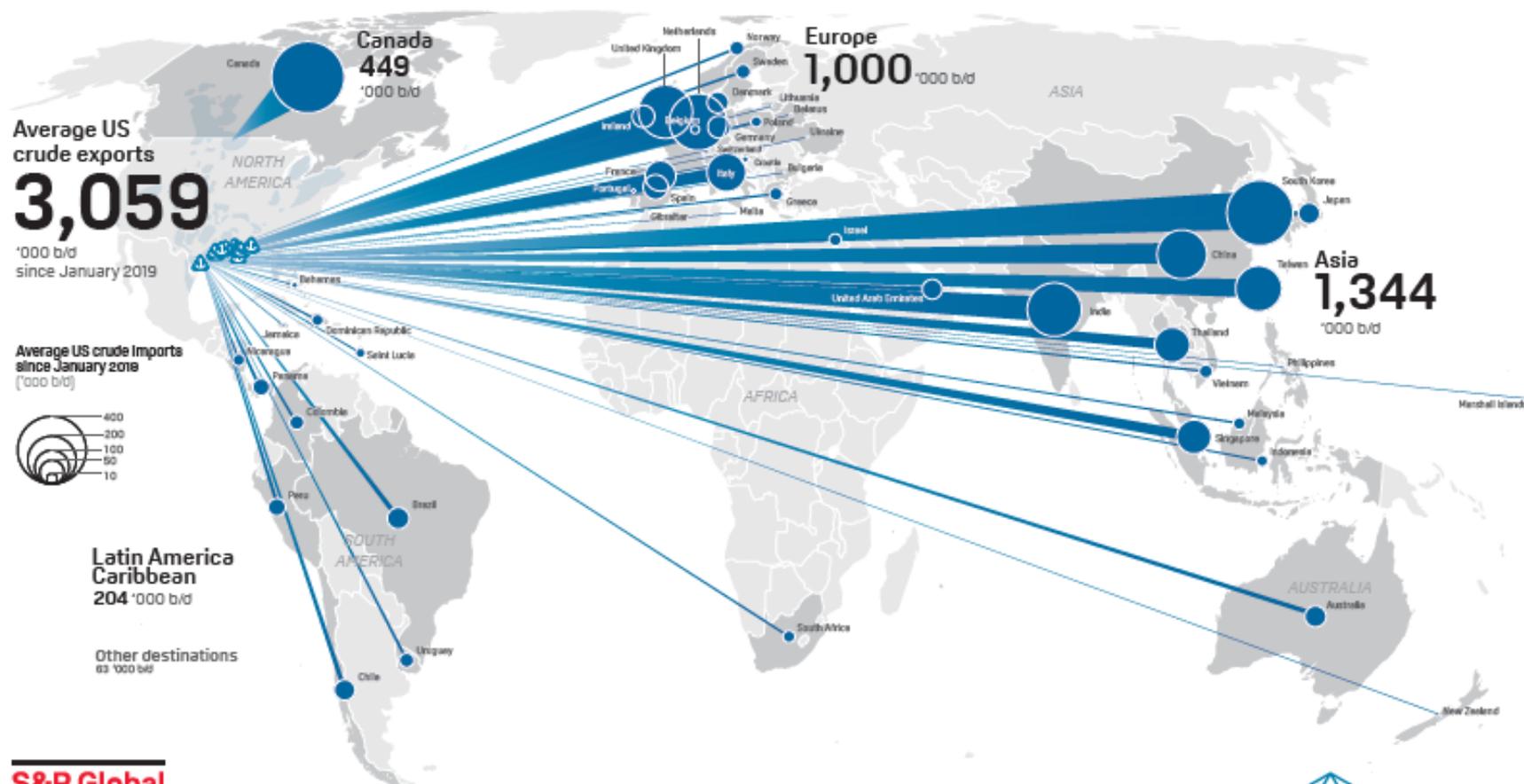
Williston Basin Oil Production & Export Capacity, BOPD

Barrels Per Day



Platts American GulfCoast Select Crude Benchmark

US crude exports have reached over 50 different countries and become an important outlet for US production. With direct-from-Permian light, sweet crude continuing to move to the global market, this important grade needs a waterborne pricing basis—free of any price distortions from logistics constraints. Platts AGS brings the US market a Dated Brent of its own.



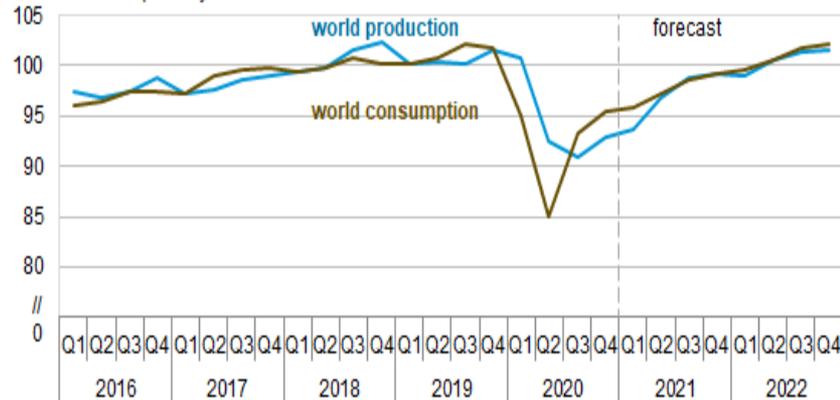
S&P Global
Platts



Source: S&P Global Platts, US Census Bureau Data
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Support +44-20-717 6-8111 or 1-800-PLATTS-6

World liquid fuels production and consumption balance

million barrels per day

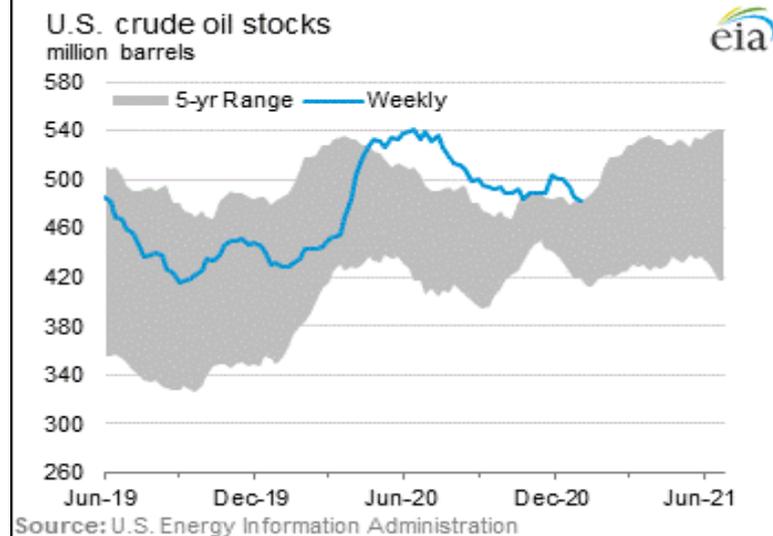


EIA Weekly Petroleum Status Report says total product supplied over the last four-week period averaged 19.1 MMBPD. Demand was down 6.4% over last year. Gasoline demand was down 13.2%, distillate up 0.3%, and jet fuel down 31.8% over the same week last year.

OPEC+ first cut output by 9.7 million bbl/d, then eased cuts to 7.7 million then to 7.2 million in January

OPEC+ raising production by 500,000 BPD in January and ? each month for the next four months.

The US passed the biggest energy bill in a decade with over \$35 billion earmarked for energy tech initiatives. The bill is a powerful blow to the US shale industry.



RECENT EVENTS

CURRENT ACTIVITY

WELLS – RIGS – JOBS – PRODUCTION

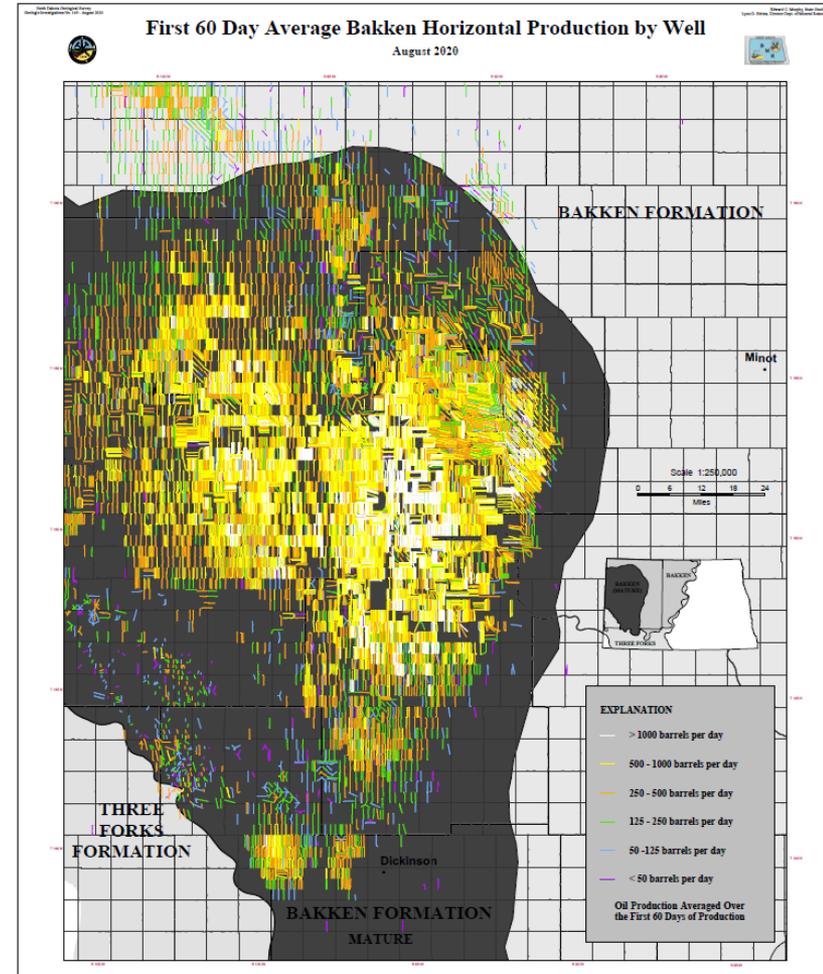
NEXT BIENNIUM 2021-2023

PRICES – PRODUCTION – JOBS

INNOVATION

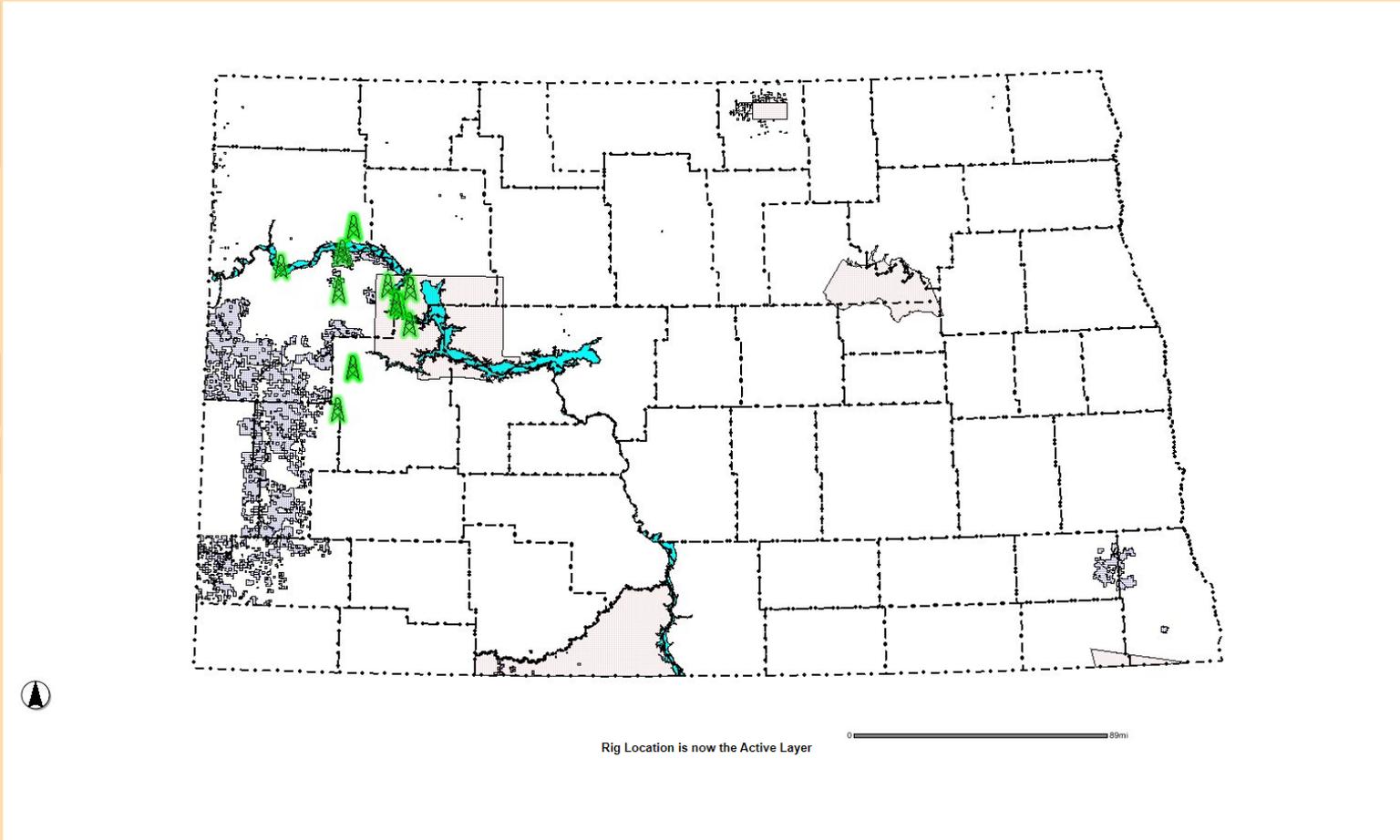
Wells

Active Nov 2020	15,371
Conventional	1,840
Bakken/Three Forks	13,531
Inactive Nov 2020	2,941
WTI \$35-\$45 < NYMEX 2Q 2020	
Waiting on Completion Nov 2020	724
WTI \$45-\$50 > NYMEX & EIA 1Q 2021	
Permitted Nov 2020	1,679
WTI \$55-\$60 for 90 days NYMEX > 10 years EIA 2024	
Increase Density Nov 2020	11,903
ICO 31114	
Total	32,618
Estimated Final	
\$60/BO = 55-65 Rigs = 20 Yr	40,000
\$70/BO = 65-75 Rigs = 45 Yr	65,000
\$80/BO = 70-80 Rigs = 70 Yr	85,000



Oil and Gas Subscription: ArcIMS Viewer

- Legend / Layers
- Overview Map
- View Entire State
- Previous View
- Clear Selection
- Search
- Create PDF
- Zoom In
- Zoom Out
- Pan
- Rect Identify
- Select Object
- Buffer
- Distance
- Find Well
- Find Field / Unit
- Find Section
- Browser Settings
- Suggestion



Download Shape Files

ND OIL & GAS LAYERS

- Oil and Gas
- Wells
- Permit Status Before Spud
- Rig Location
- Directional Surveys
- Directional Legs
- Horizontal Surveys
- Horizontal Legs
- Cases Docketed
- Oil Fields
- Unit Boundaries
- Inspector Areas
- Drilling / Spacing
- Seismic
- Gas Plants
- Other
- Railroads
- Reservations
- Corporate Boundaries
- Rivers and Roads
- Land Ownership
 - FortBerthold Mineral Tracts
 - FortBerthold Surface Tracts
 - Surface Ownership - ND La
 - BLM Lands
 - US Forest Service

Refresh Map
 Auto Refresh

Help:

- A closed group, click to open.
- An open group, click to close.
- A map layer.
- A hidden group/layer, click to make visible.
- A visible group/layer, click to hide.
- A visible layer, but not at this scale.
- A partially visible group, click to make visible.
- An inactive layer, click to make active.
- The active layer.

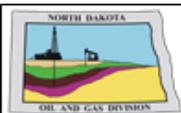
Rig Location is now the Active Layer



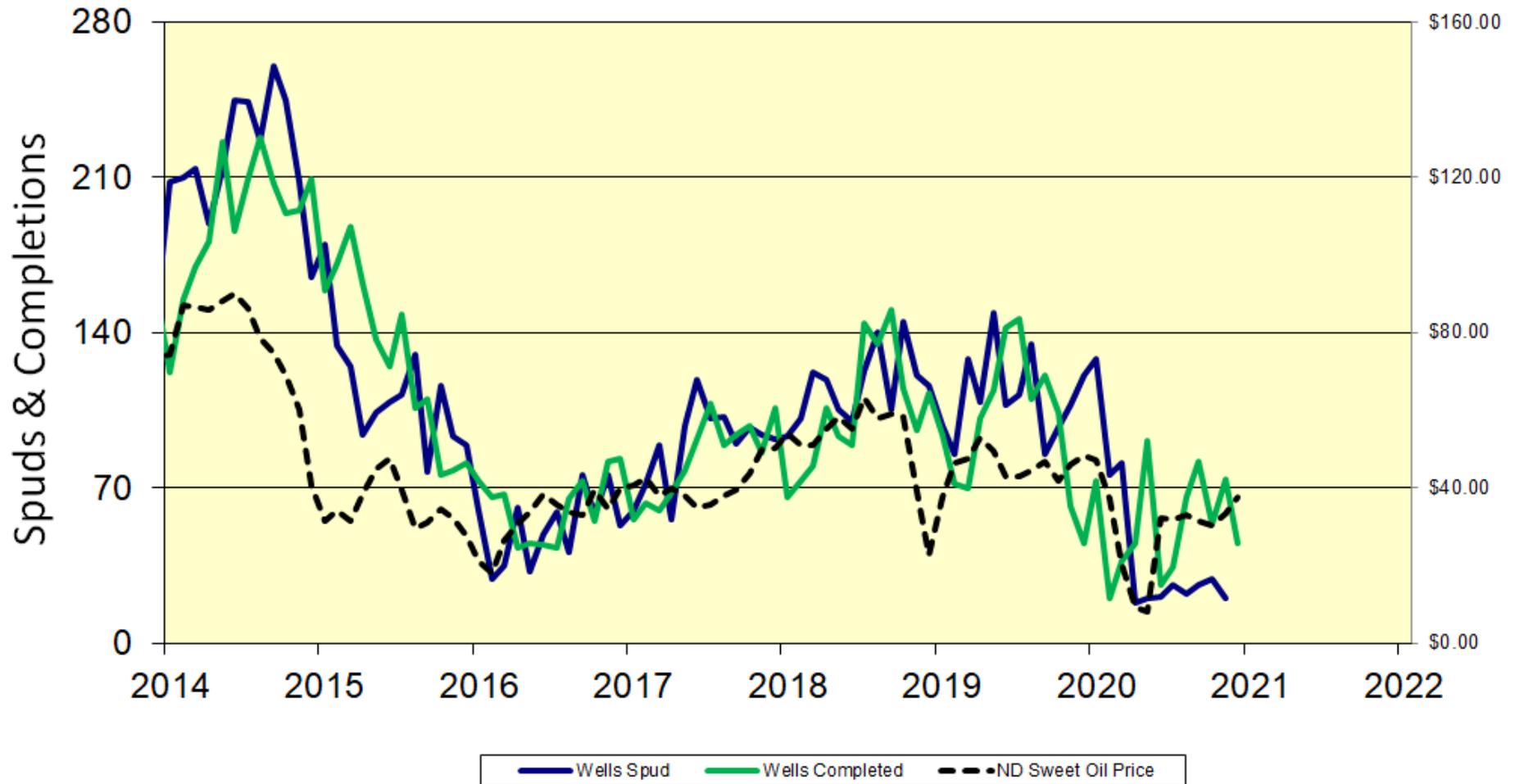
Map Data Last Updated : 1/19/2021

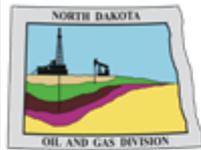


12 rigs

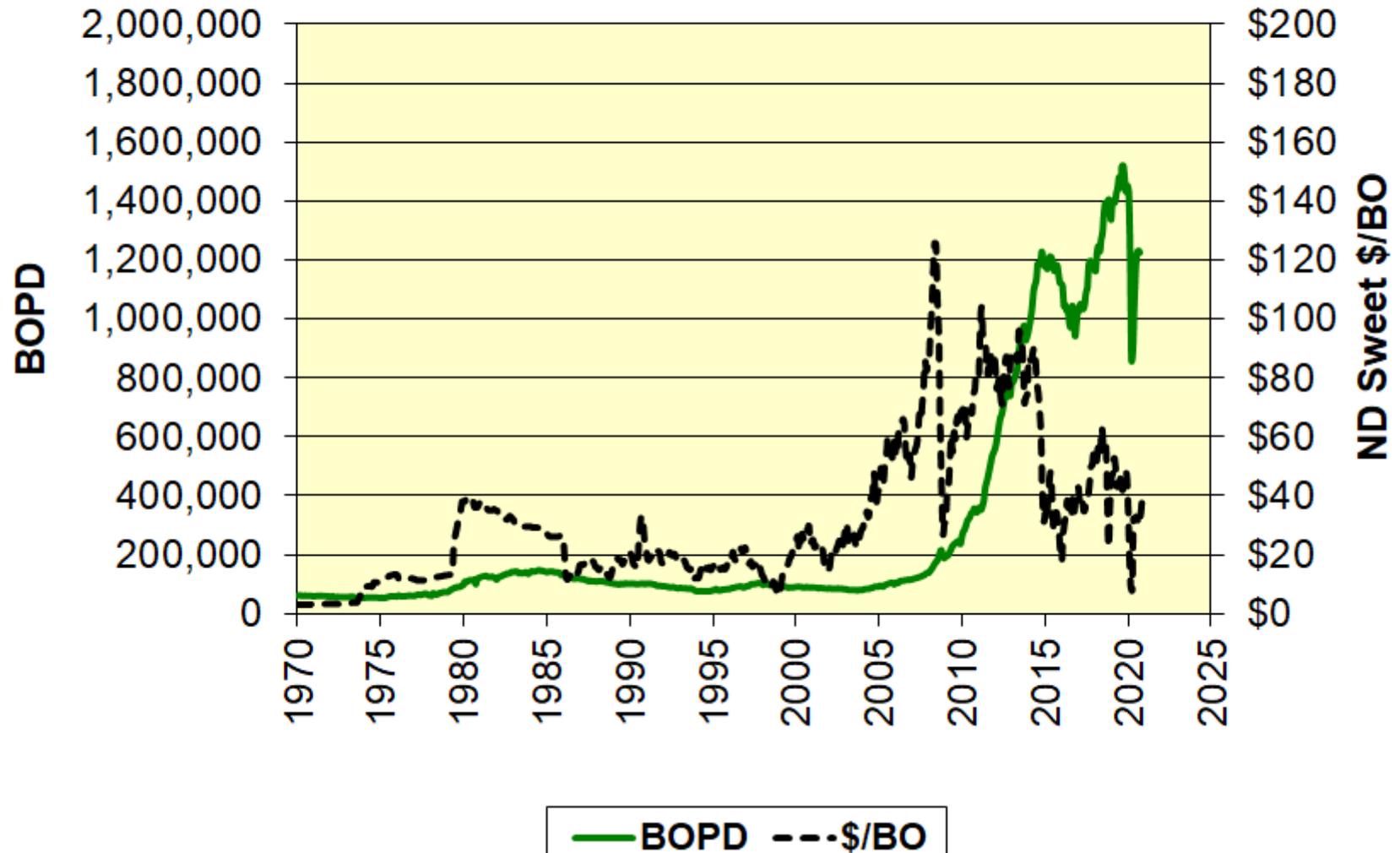


North Dakota Monthly Spuds & Completions

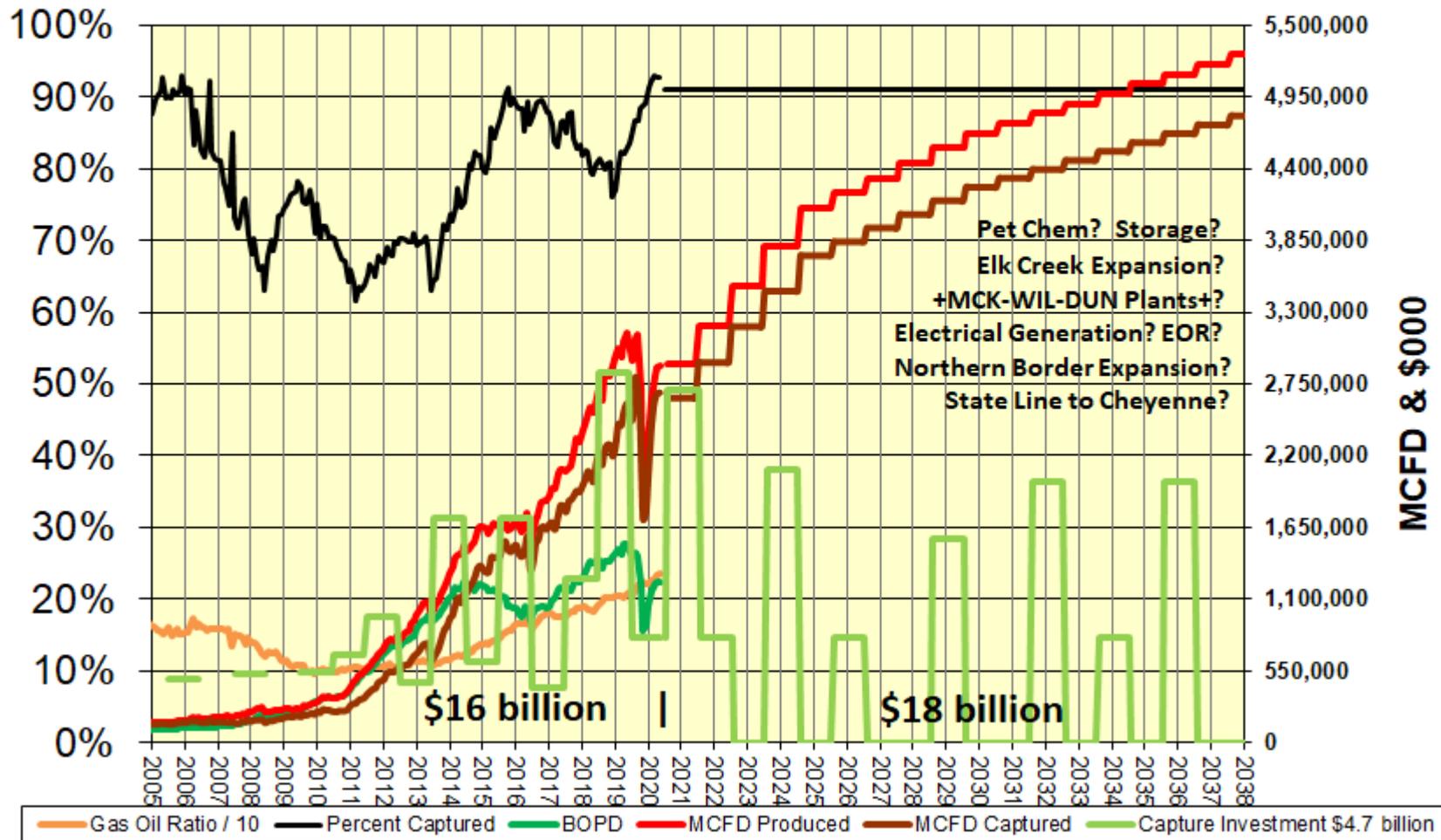
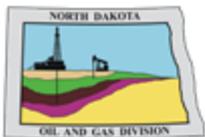




North Dakota Daily Oil Produced and Price

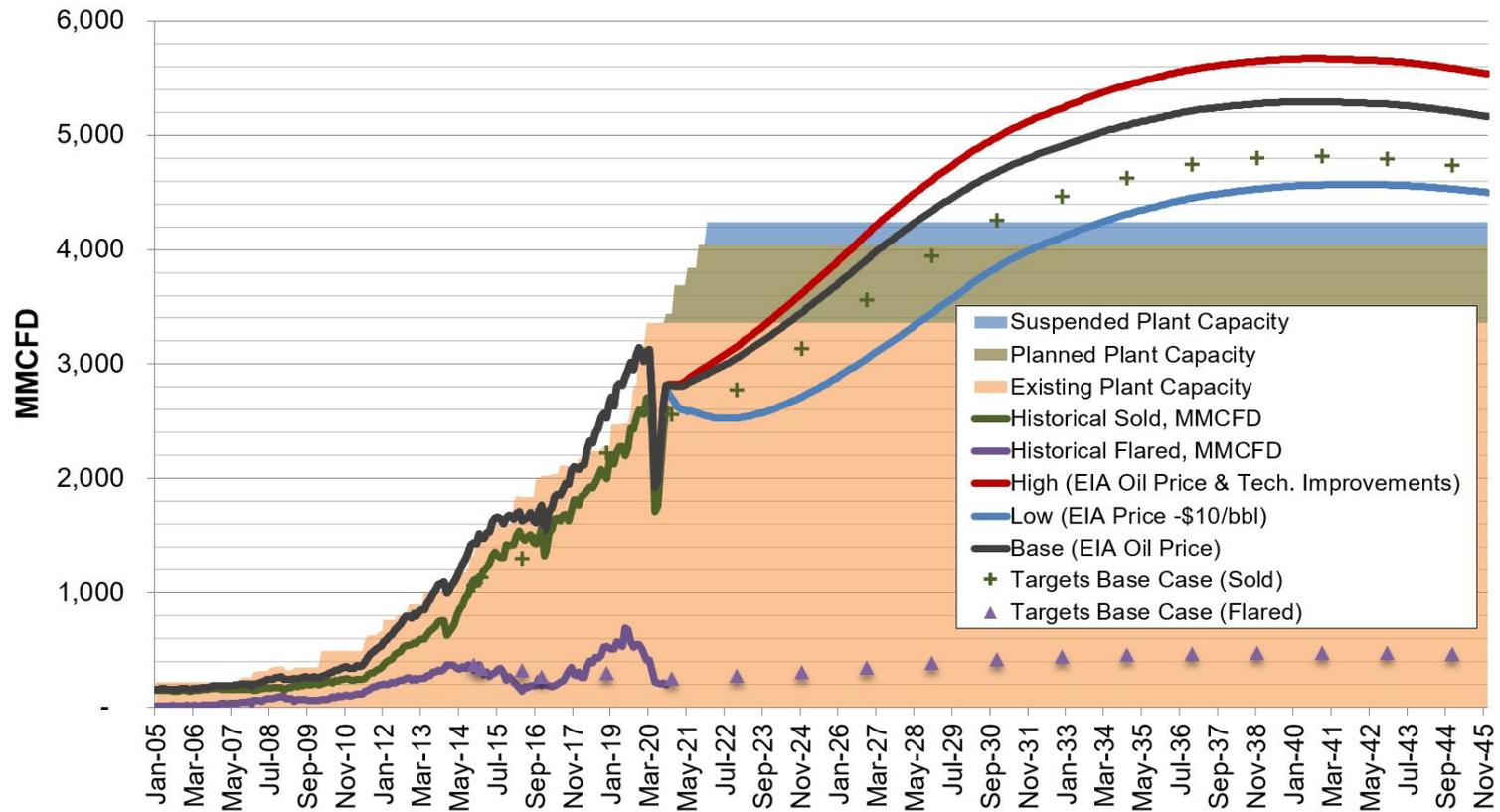


North Dakota Monthly Gas Captured



Solving the Flaring Challenge

Assumes Current Technology – Enhanced Oil Recovery Not Included



North Dakota Idle Wells



RECENT EVENTS

CURRENT ACTIVITY

WELLS – RIGS – JOBS – PRODUCTION

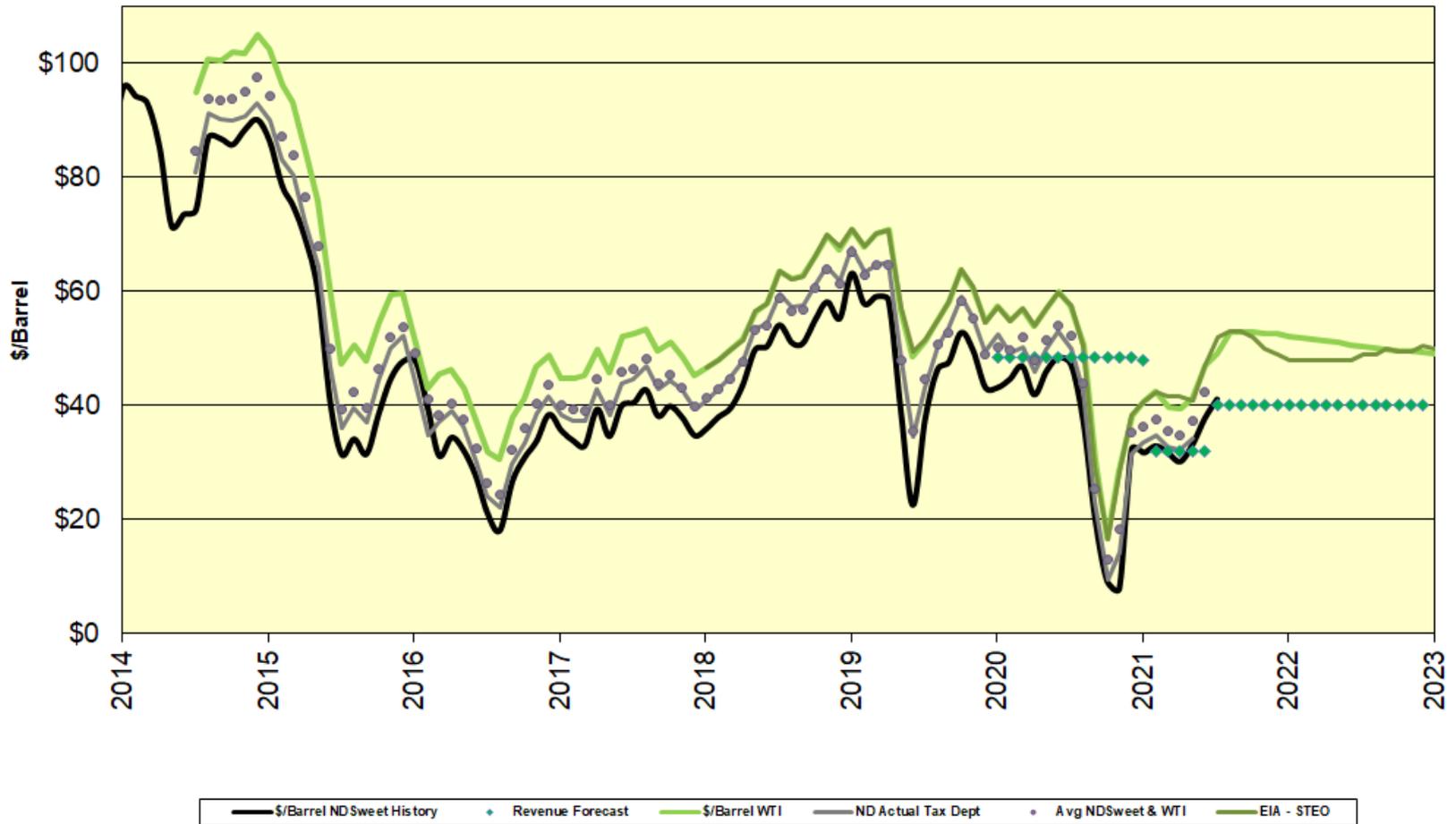
NEXT BIENNIUM 2021-2023

PRICES – PRODUCTION – JOBS

INNOVATION



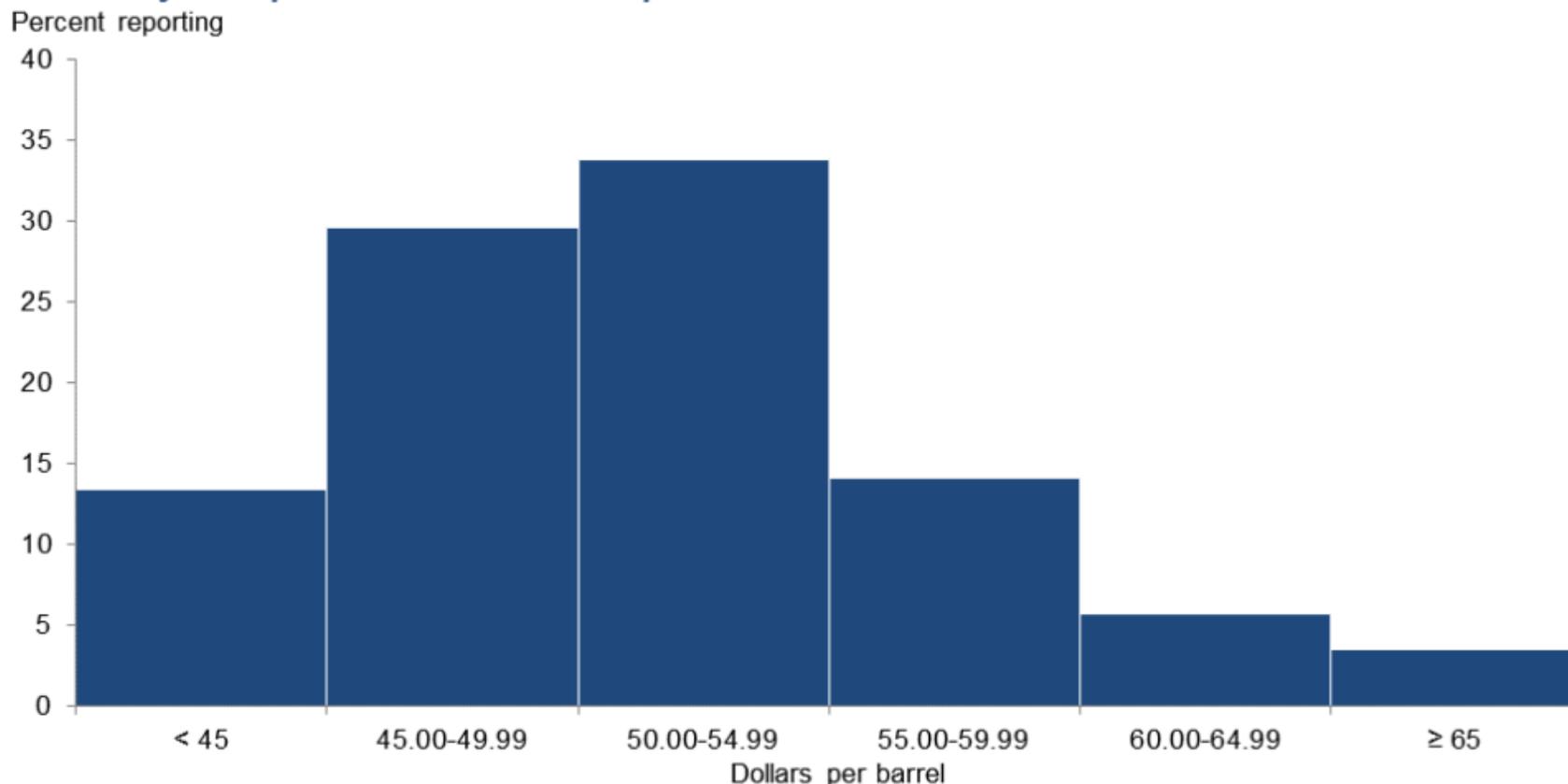
North Dakota Oil Price Projections



Price Forecasts

West Texas Intermediate Crude

What do you expect the WTI crude oil price to be at the end of 2021?



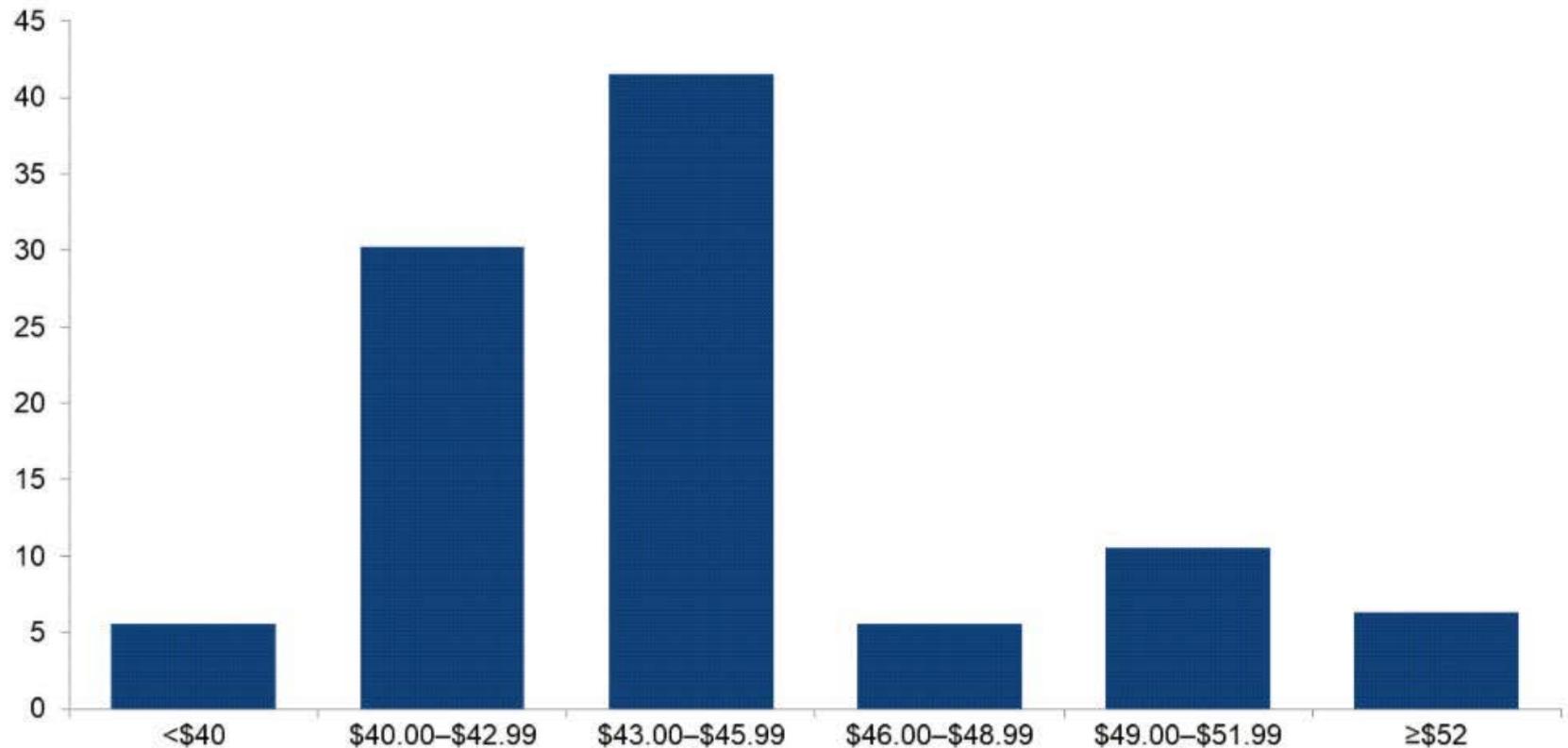
NOTES: Executives from 142 oil and gas firms answered this question during the survey collection period, Dec. 9–17, 2020. For reference, WTI (West Texas Intermediate) spot prices averaged \$47.09 per barrel during the period.

SOURCES: Federal Reserve Bank of Dallas; Energy Information Administration (reference price).

What West Texas Intermediate crude oil price is your firm using for capital planning in 2021?

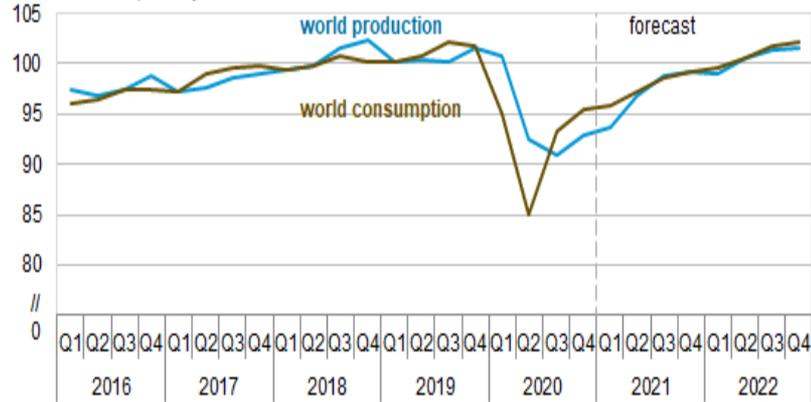
For this special question, executives were asked to provide the WTI price they used for planning their capital expenditures in 2021. The average response was \$44 per barrel, with the median and the mode at \$45 per barrel.

Percent of respondents



NOTE: Executives from 142 oil and gas firms answered this question during the survey collection period, Dec. 9–17, 2020.
SOURCE: Federal Reserve Bank of Dallas.

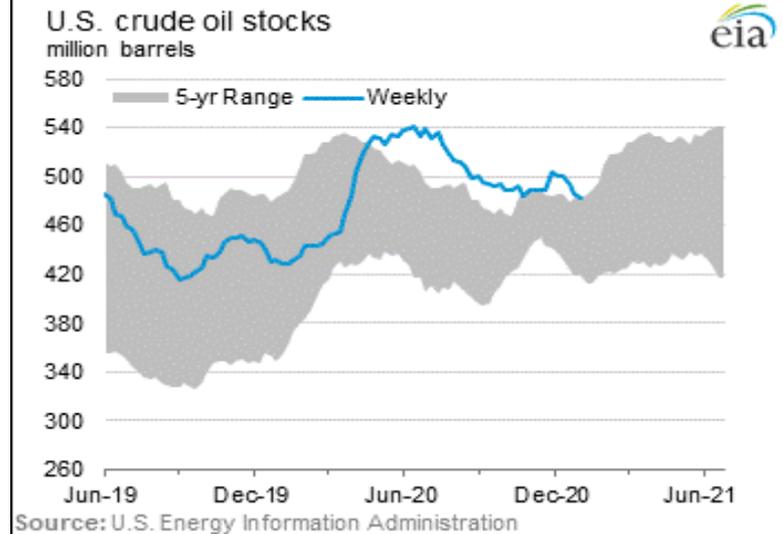
World liquid fuels production and consumption balance
million barrels per day



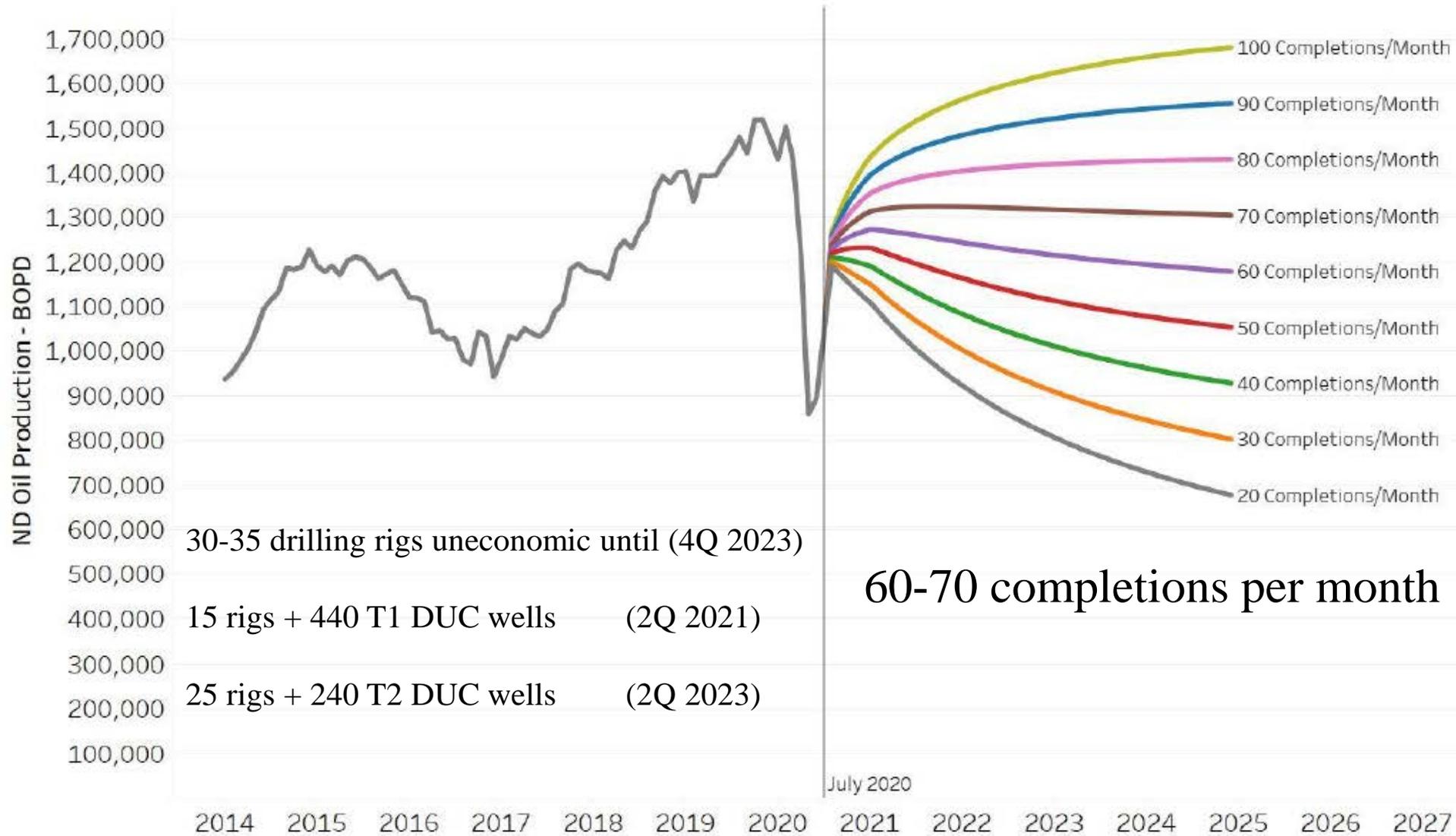
As demand recovers, OPEC+ plans to respond in kind to maintain the market balance, carefully keeping prices low enough to stifle any meaningful US shale resurgence. Russia sees the global economy teeing up a “demand party” and supports OPEC+ raising production by 500,000 BPD each month for the next four months. It sees oil prices between \$45 and \$55 per barrel as being optimum.

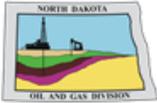
BlackRock is leading the charge on Wall Street to “sustainability”, with 77% of investors committed to investing only in “sustainable” companies. A \$120 trillion transformation is anticipated.

The US regulatory environment is expected to block growth in oil and gas. Industry may not be allowed to get new leases on federal lands, to disturb wildlife to drill, to frac completions, to flare gas while a pipeline is being built, or to build and replace pipelines to get it to market.

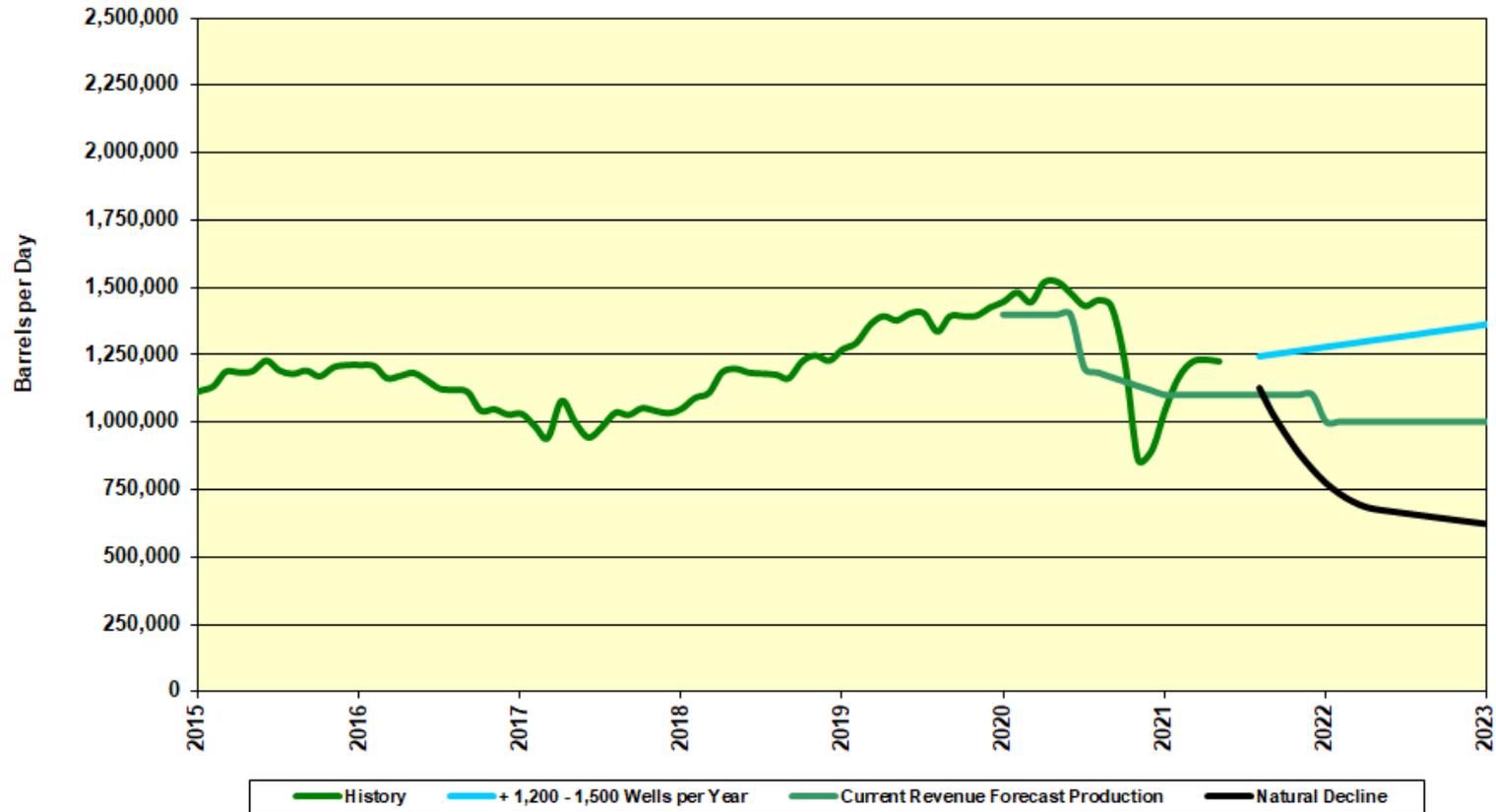


Monthly Completion Scenarios - Oil

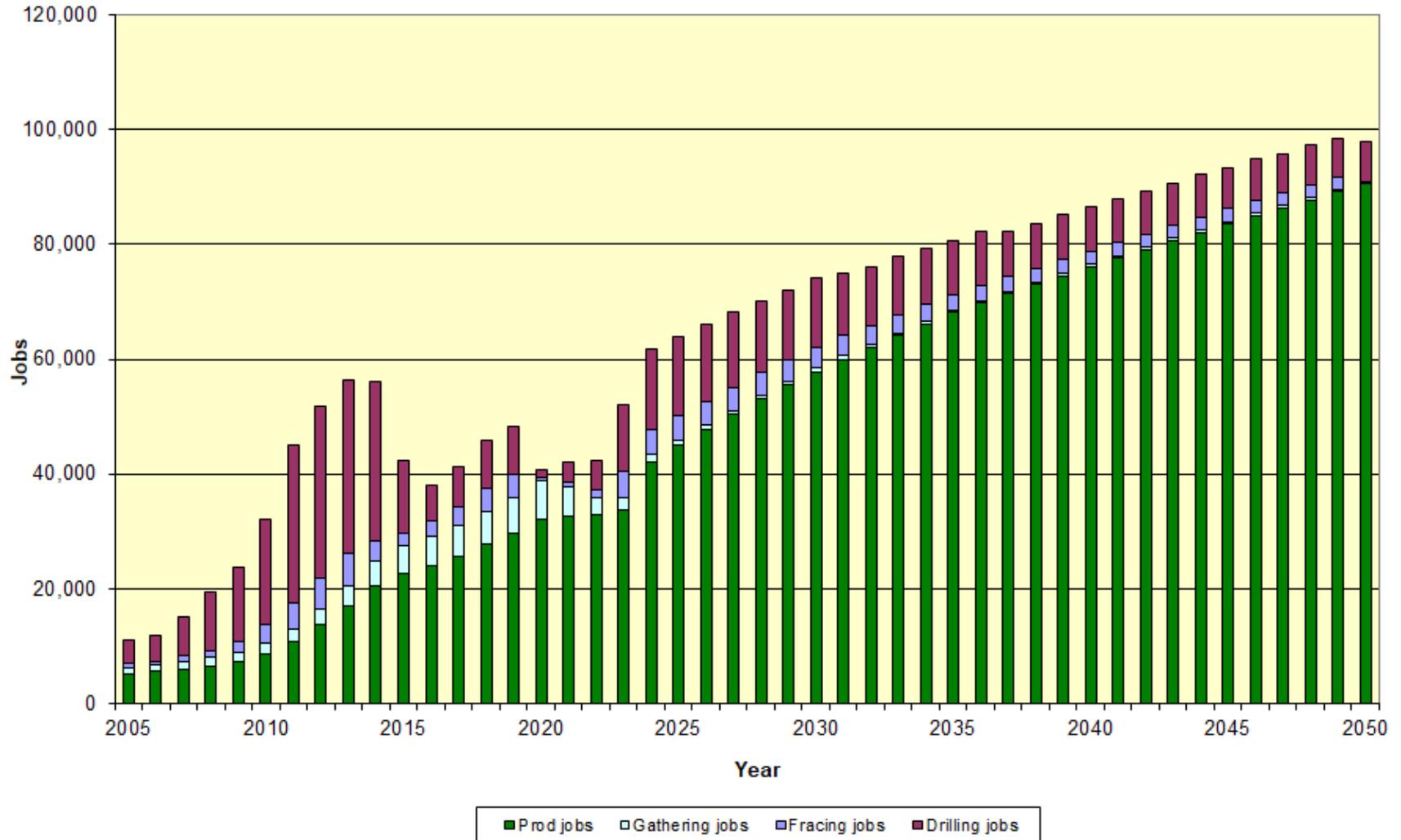




North Dakota Oil Production



North Dakota Oil Industry Jobs



RECENT EVENTS

CURRENT ACTIVITY

WELLS – RIGS – JOBS – PRODUCTION

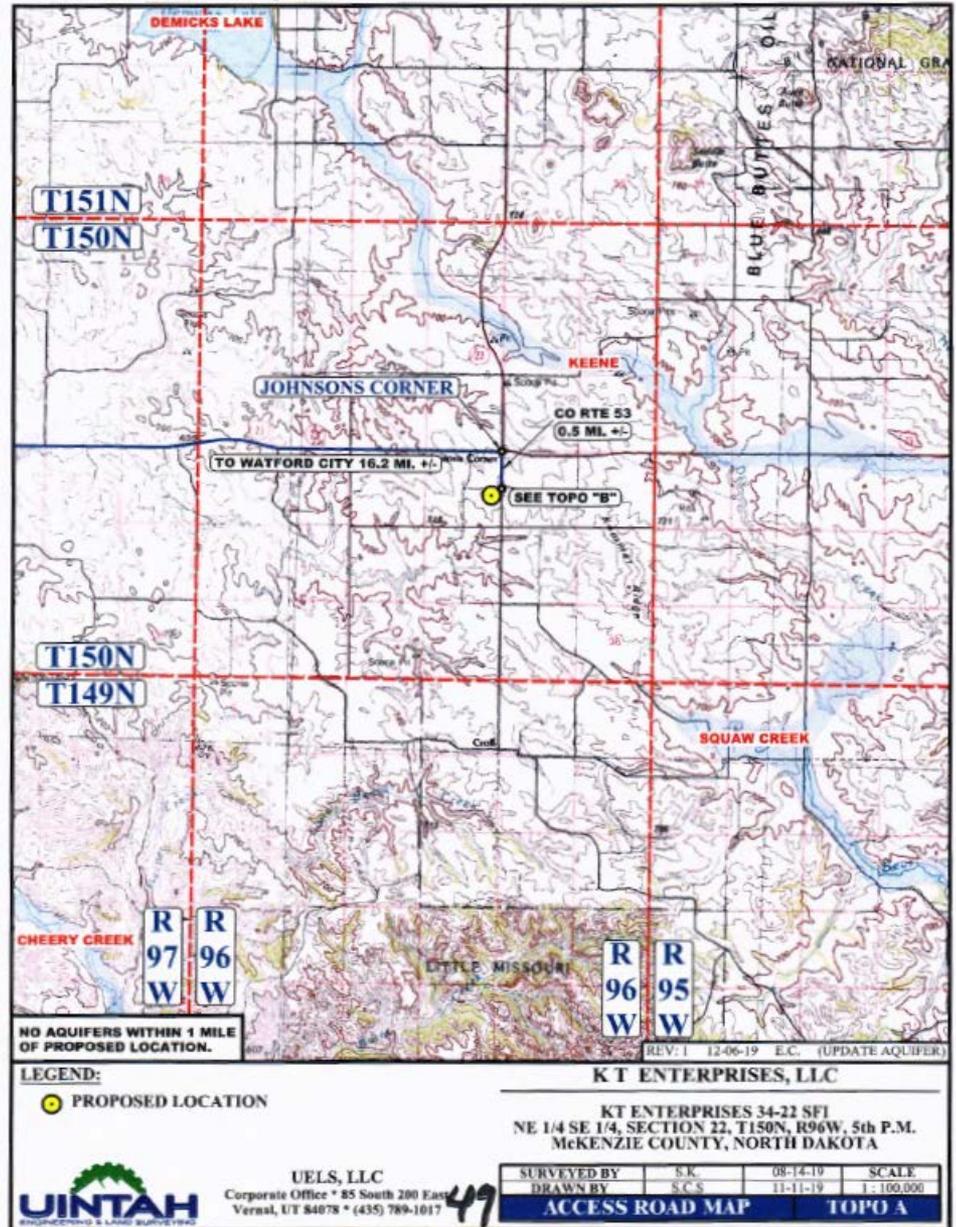
NEXT BIENNIUM 2021-2023

PRICES – PRODUCTION – JOBS

INNOVATION

Waste Disposal

Attachment No. 16: Surficial Aquifers





Predicting Oil Production Using Machine Learning

BPOP Members Presentation
via WebEx
September 30, 2020

Alex Chakhmakhchev and Xue Yu

© 2020 University of North Dakota Energy & Environmental Research Center

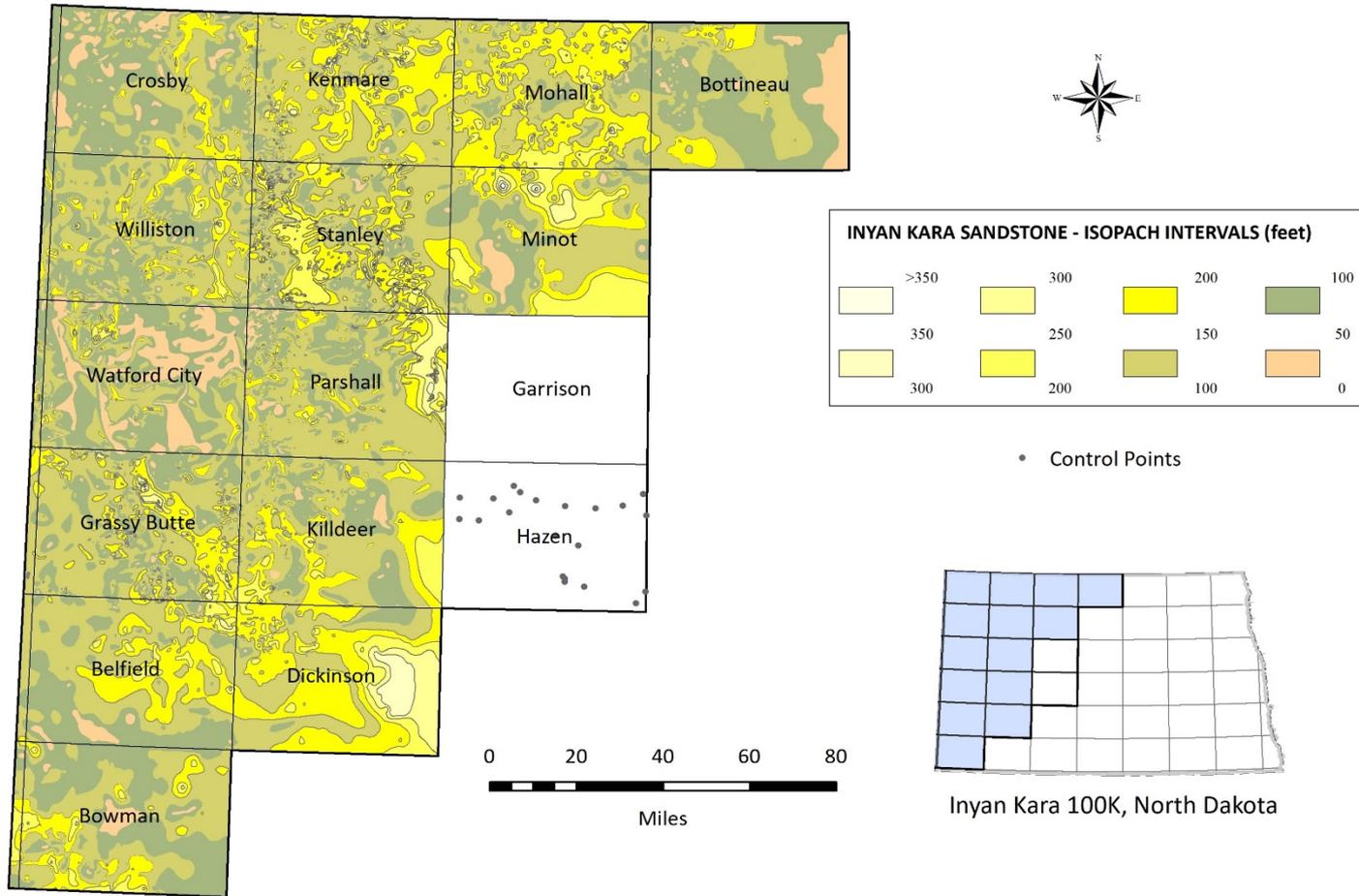
The top four most important variables from both models were “Total Proppant,” “Total Fluid,” “Total Fluid per Interval Length,” and “Number of Wells within one DSU.”

Sensitivity analysis showed that oil production did not always increase beyond a threshold value for a specific completion variable, suggesting that optimal combinations of the completion variables exist. Optimal values have been calculated for the fluid, proppant, stage count, and number of wells per DSU. There are complex relationships among the completion variables that result in interactive effects.

CARES ACT FUNDING PROJECTS

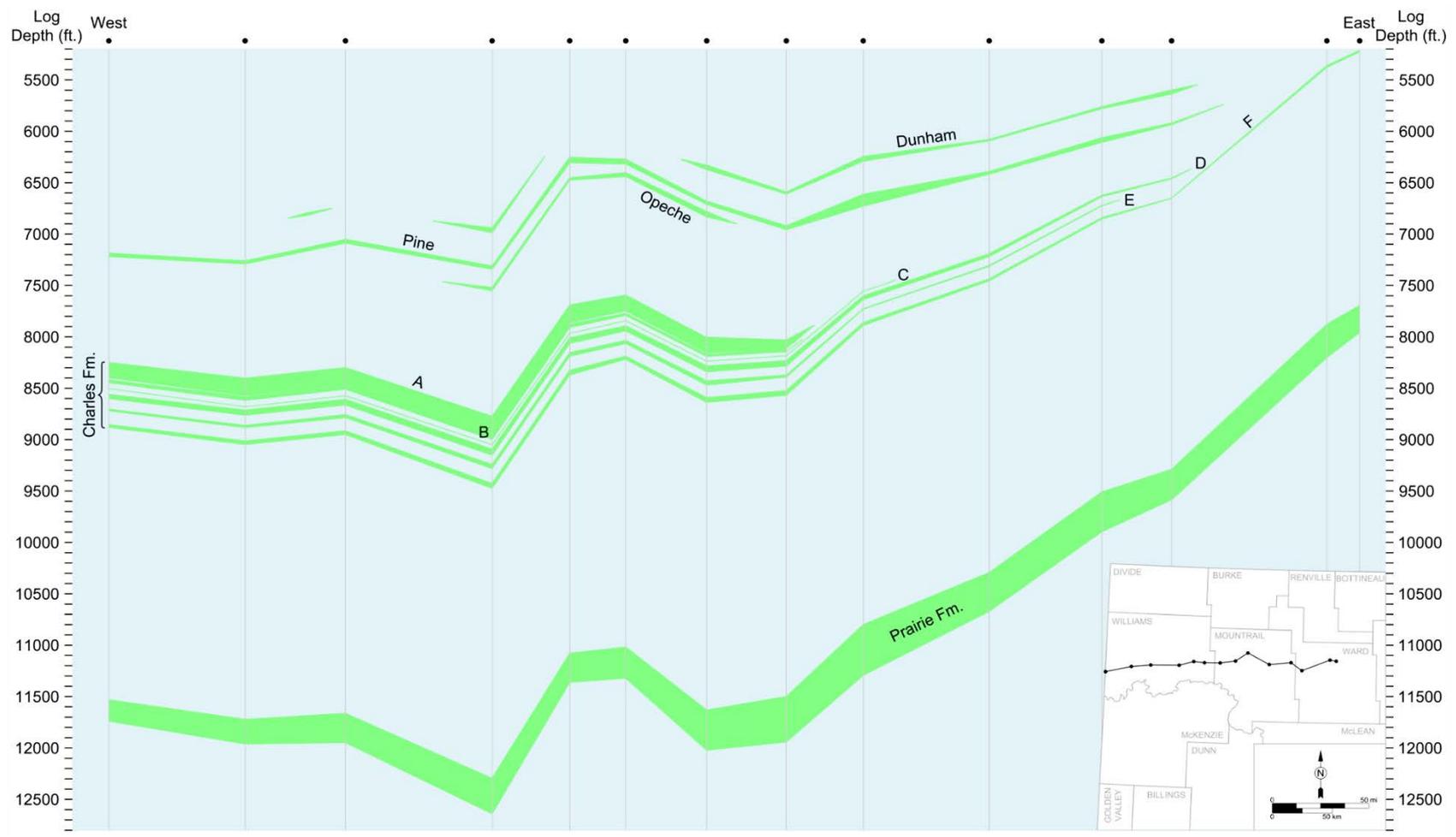
	<i>Amount Awarded</i>	<i>Invoices to Date</i>	<i>Waiting for Invoices</i>
<u>Plugging</u> Plugging of Abandoned wells in North Dakota confiscated by the NDIC.	\$33,175,000 375 wells	\$35,975,186 152,704 man-hours 1,380 FT jobs 280 wells	\$15,006,071 95 wells
<u>Reclamation</u> Reclamation of abandoned sites confiscated.	\$16,300,000 185 sites	\$19,713,374 16,364 man-hours 1,925 FT jobs 146 sites=730 acres	\$34,333,641 229 sites
<u>DUC Well Completions</u> Reimbursement of funds for water acquisition, handling, and disposal for completion of DUC wells.	\$16,000,000	\$2,171,896 10 ND companies 400 FT jobs \$1,465,000 sales tax 15 wells	\$13,828,104 \$6,350,000 sales tax 65 wells
<u>Operating</u> Covid-19 costs: hand sanitizer, non-contact thermometers, webinar upgrade, etc.	\$1,512	\$1,512	
	\$65,476,512 1,875 acres 1,230 crop 645 pasture	\$51,648,408 3,705 FT jobs \$7,815,000 sales tax	CA \$13,828,104 2021>P&R 49,339,712 AWPSRF 10,000,000 SW Bonds 6,895,000 Judgements? 32,444,712

INYAN KARA FORMATION (saltwater disposal)

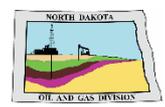


Survey geologists began constructing 1:100,000 scale maps of the Inyan Kara Formation (Dakota Group) in 2015. These maps highlight the areas of greater cumulative sandstone thicknesses (bright yellow) in contrast to the areas containing less sandstone (brown, green, and pink) to assist companies in choosing where to drill or convert existing wells to saltwater disposal wells. Three map sheets were completed this biennium (Belfield, Dickinson, and Bowman).

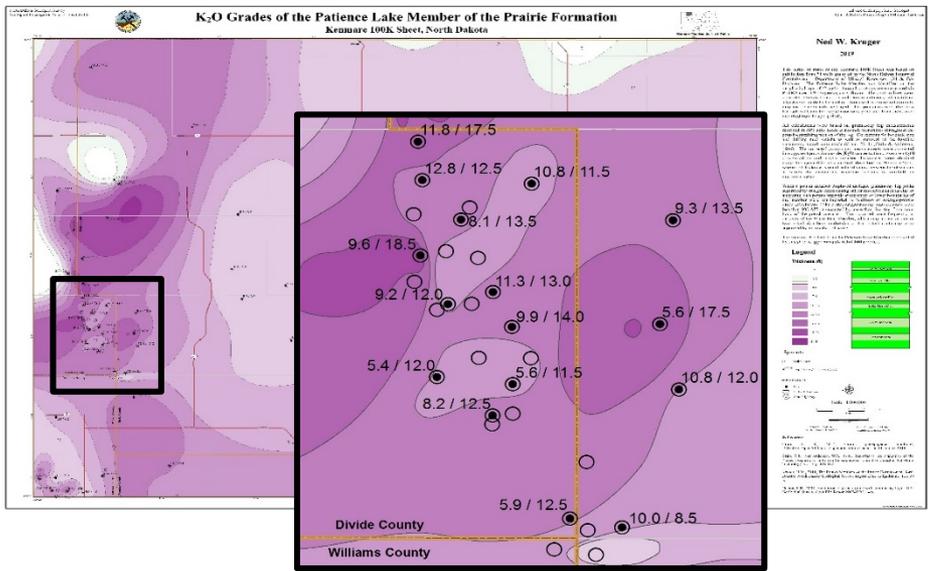
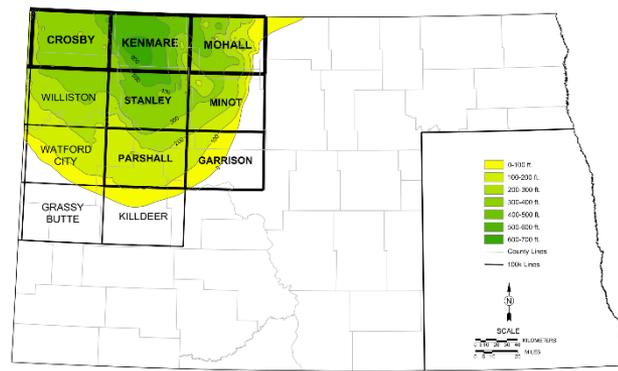
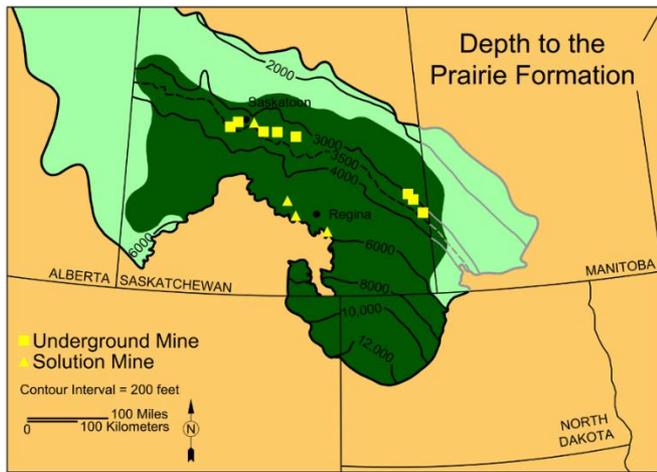
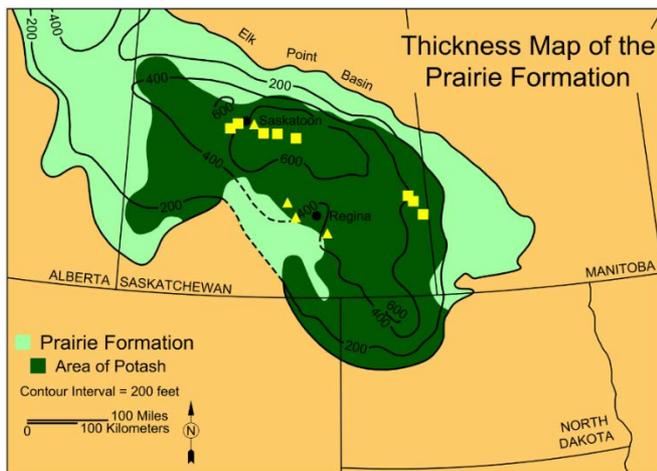
SALT LAYERS IN NORTH DAKOTA



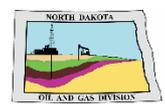
This biennium, Survey geologists mapped both the shallowest salts (Dunham, Pine, and Opeche) and the deepest salt layer in the Williston Basin (the Prairie Formation) for hydrocarbon storage potential and (in regards to the Prairie Formation) potash potential.



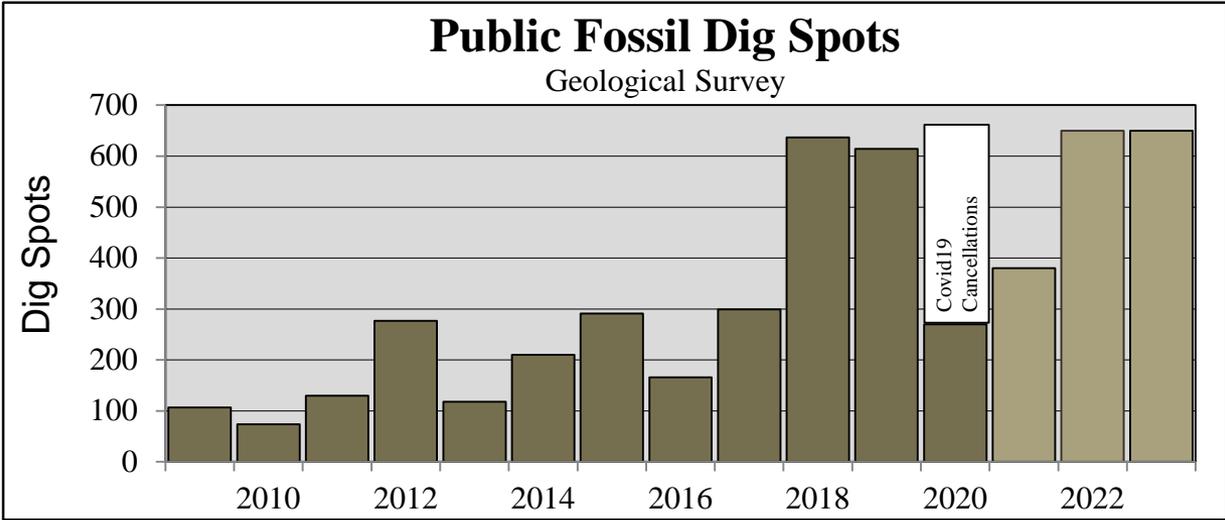
PRAIRIE FORMATION (potash -- potassium salts)



Left: Depth and thickness maps for the Prairie Formation. There are 12 potash mines operating in Saskatchewan. Upper right: We have generated seven, 100K depth and thickness maps of the Prairie Formation (bold outline). In addition, for three of these (Crosby, Kenmare, and Mohall) we have also compiled detailed potassium oxide maps for each of the six potash members (lower right).

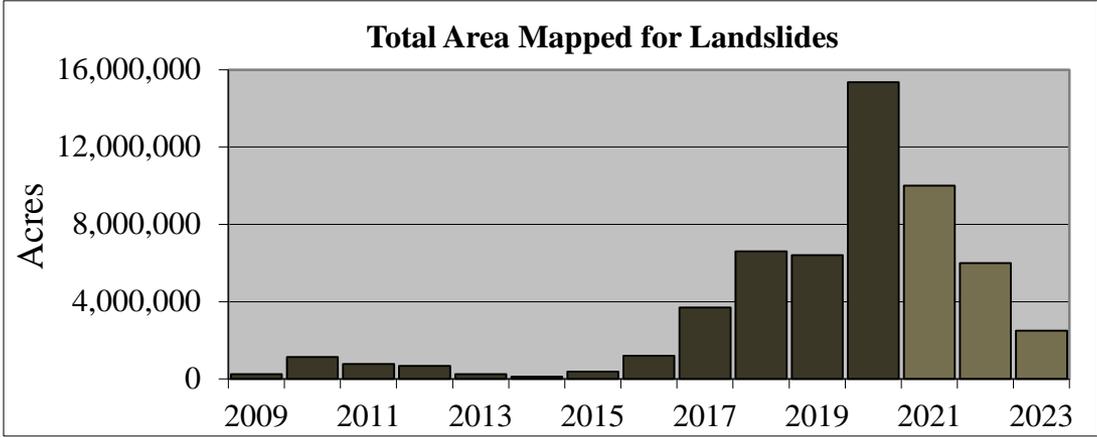


PUBLIC FOSSIL DIG PROGRAM

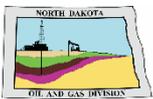


Left: Some of the participants at the 2020 Pembina digging in the Pierre Formation. Right: Part of a jaw (the finger is pointing to it) and bones from a six-foot-long, 80-million-year-old, saltwater-fish uncovered at the 2020 Pembina dig.

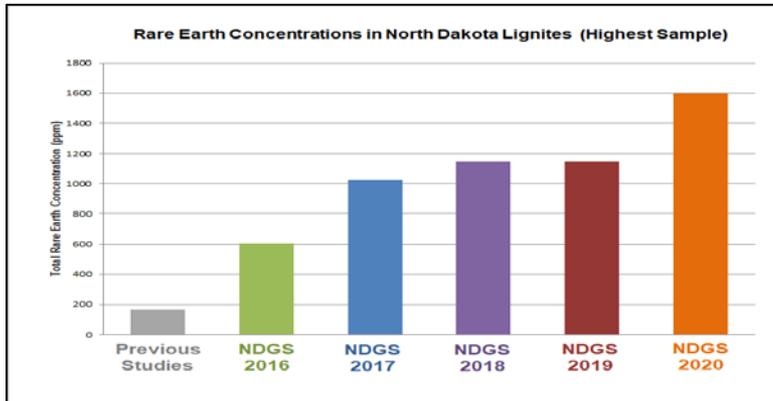
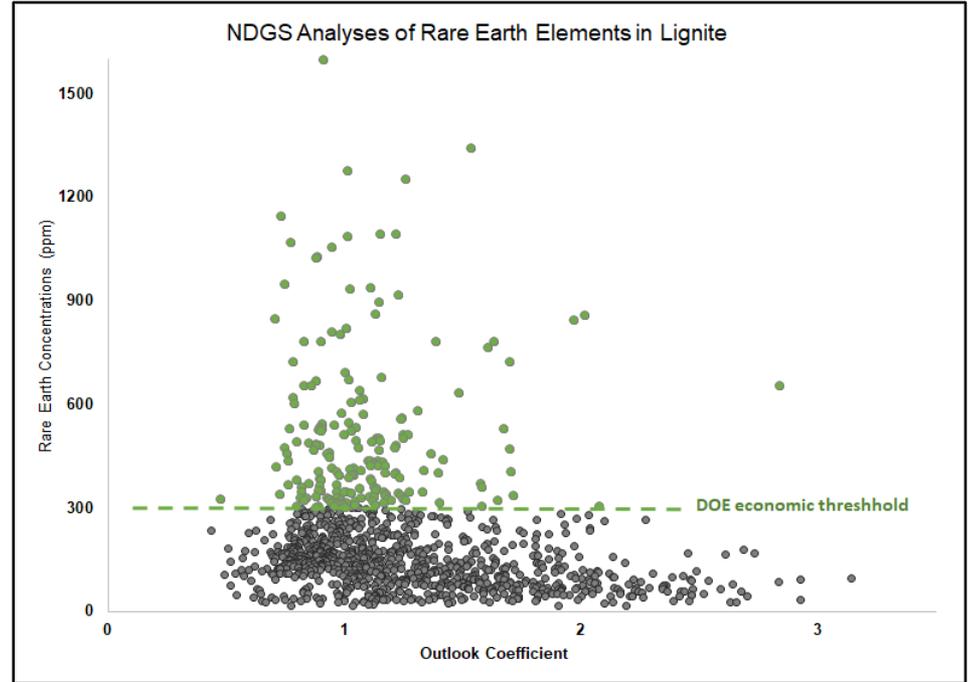
LANDSLIDE MAPPING PROGRAM



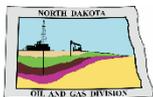
Top: Survey geologists mapped more than 19 million acres this biennium. Left: Launching the Survey drone at a two-hour old landslide on River Road north of Bismarck. Right: A landslide we are monitoring with our drone along ND Highway 22 north of Killdeer.



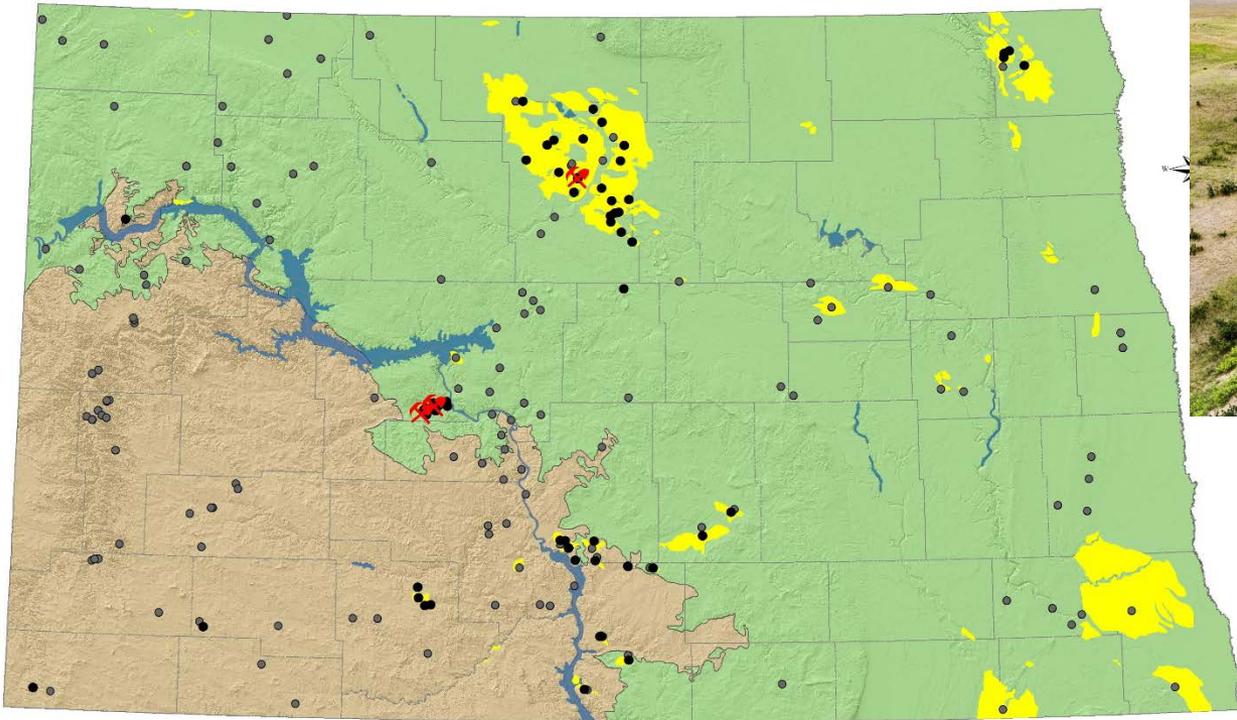
RARE EARTH SAMPLING PROJECT (2015-2021)



Upper Left: One of the Geological Survey 2020 study sites along the Little Missouri River in Slope County. Lower left: Prior to the Geological Survey study, the highest rare earth concentration reported from a North Dakota lignite was 165 parts per million, now it is 1,598 ppm. Right: The rare earth element concentrations of 190 of the 1,105 Geological Survey samples exceed the U.S. Department of Energy's economic threshold of 300 parts per million.



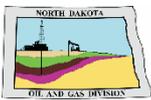
PROPPANT SAND PROJECT (2019-2021)



- Sampled in 2010-2018
- Sampled 2019-2021 Biennium
- Sedimentary Bedrock
- Glacial Drift
- Windblown Sand
- 🔨 Active Proppant Sand Mining Locations

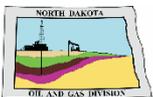
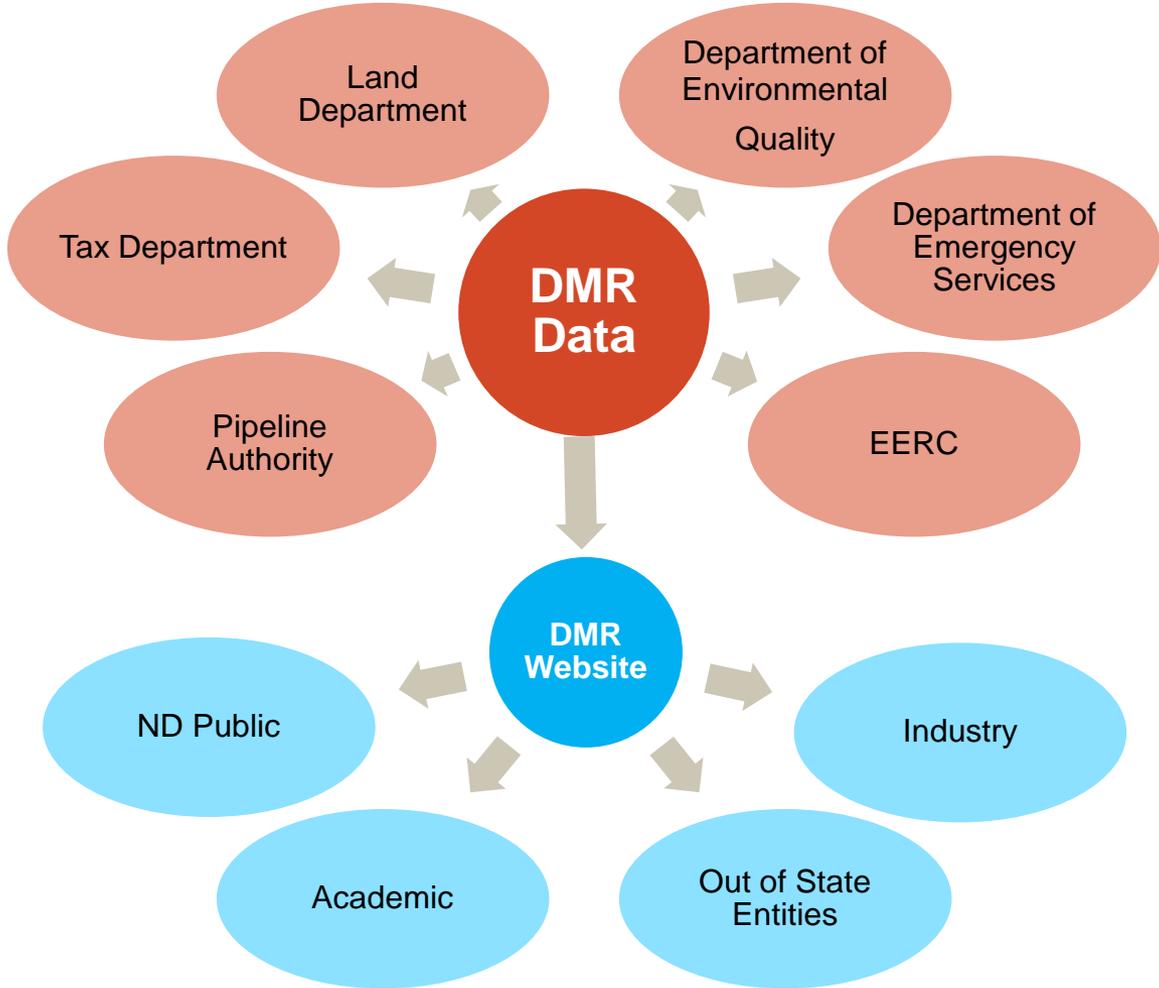


Left: A generalized surface geology map of North Dakota with sample locations plotted on it. Upper right: A blowout on the crest of a dune in the Hazen-Stanton dune field. Lower right: A Survey geologist collecting a windblown sand sample in the Denbigh dune field.



RBDMS UPGRADE "NORTHSTAR" PROJECT

(DATA SHARING)

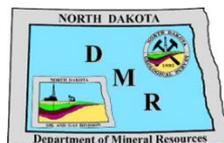


NORTH DAKOTA
DEPARTMENT OF MINERAL RESOURCES
CONTACT US

600 East Boulevard Ave. – Dept. 405
Bismarck, ND 58505

Phone: 701.328.8020

Email: oilandgasinfo@nd.gov



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