House Appropriations Committee SB 2014

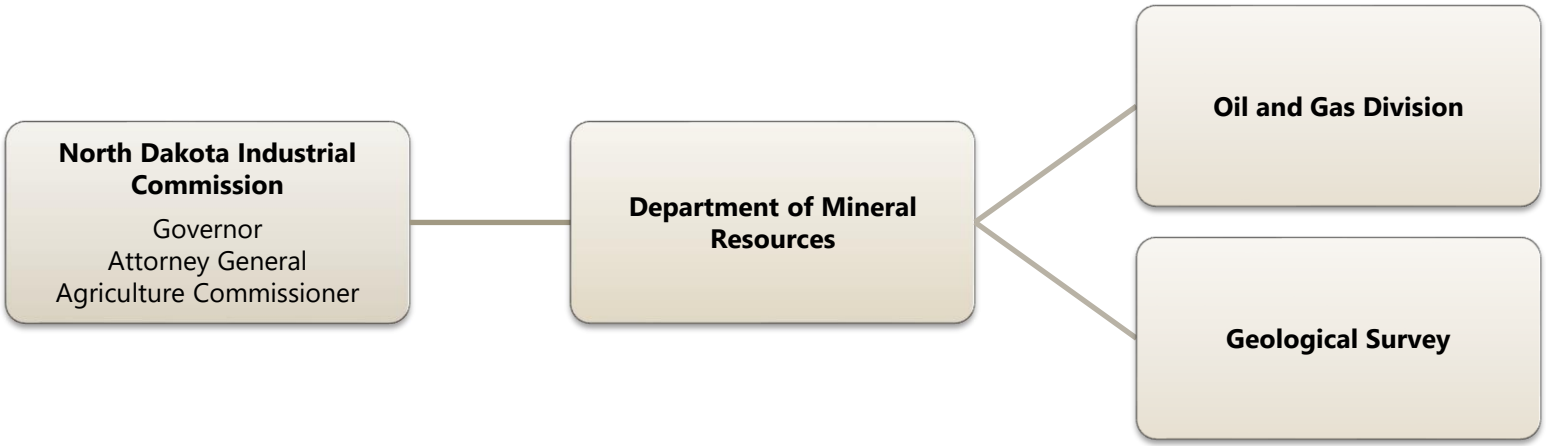
Lynn D. Helms, Director
Department of Mineral Resources
North Dakota Industrial Commission

AGENCY OVERVIEW

NORTH DAKOTA DEPARTMENT OF MINERAL RESOURCES

The Legislature created the Industrial Commission of North Dakota in 1919 to conduct and manage, on behalf of the State, certain utilities, industries, enterprises, and business projects established by state law. The Industrial Commission has jurisdiction over oil and gas resources, the investigation and publication of geological information and the regulation of coal exploration, geophysical exploration, geothermal energy, paleontology resources, subsurface minerals, geophysical exploration, and carbon dioxide underground storage in North Dakota through the Department of Mineral Resources Geological Survey and Oil and Gas Division.

The Industrial Commission appoints the Director of the Department of Mineral Resources, who serves as Director of the Oil and Gas Division and appoints the State Geologist and Assistant Director of the Oil and Gas Division.



ORGANIZATIONAL STRUCTURE

Department of Mineral Resources
Director (1)

Oil and Gas Division:
Assistant Director Oil and Gas Division (1)

Field Staff (34)
Pipeline Program (10)
Reclamation Program (2)
Permitting (5)
Geological Analyst/CCUS (2)
Logs (3)
Petroleum Engineering (2)
Production/Measurement (5)
UIC/Treating Plants (2)
Bonding (1)

Contingent Positions (2)

Total Oil and Gas Division: 69

DMR Support:
EGIS Staff Officer (1)

IT/Data Management (5)
Administrative Assistants (2)
Finance/Accounting (3)
Legal/Hearing Dockets/Orders (2)
Public Information Officer (1)
Safety Officer (1)
Human Resources (1)
Warehouse Technician (.5)

Total DMR Support: 16.5

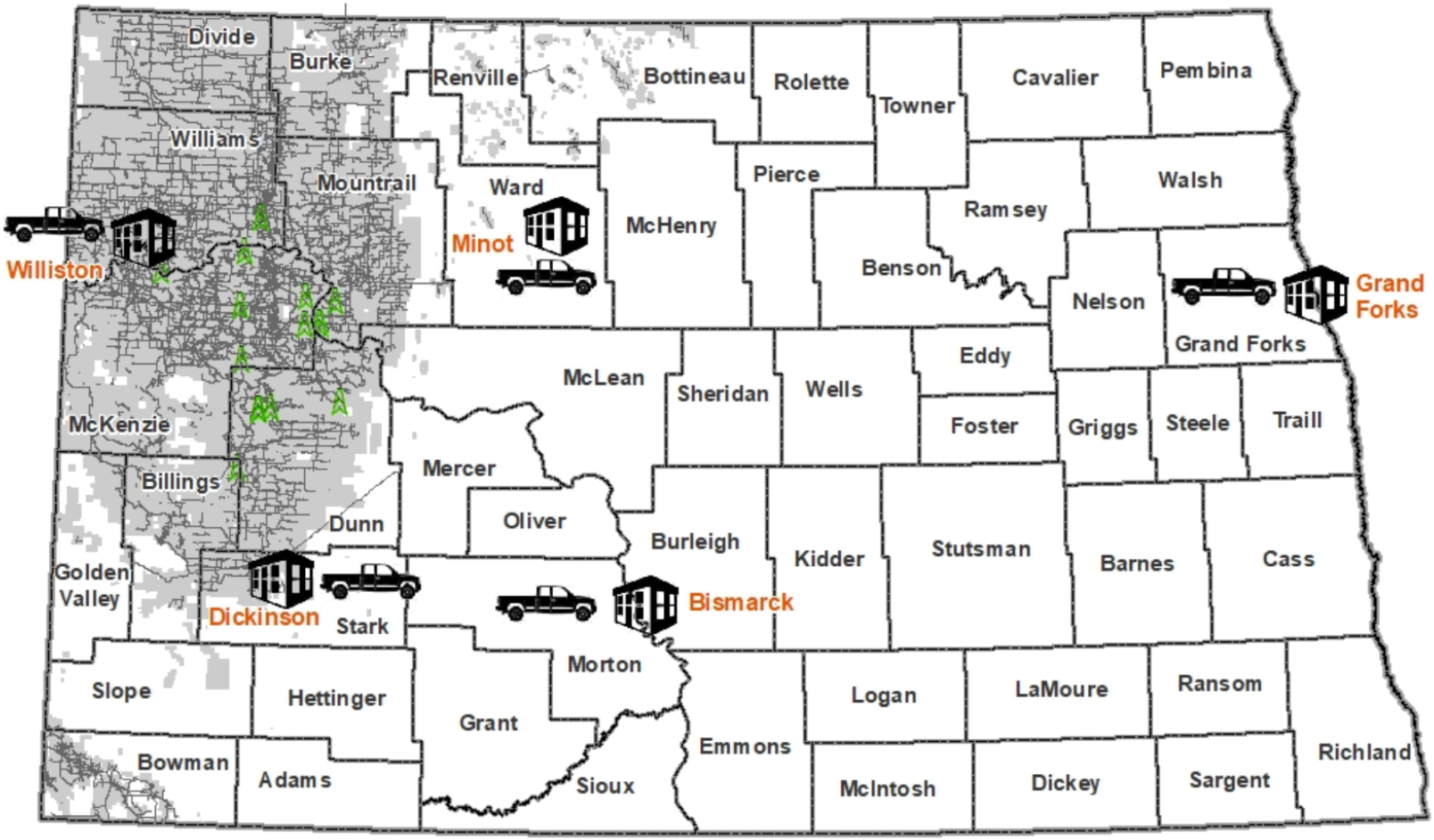
Geological Survey:
Assistant Director State Geologist (1)

Paleontology (3)
Geo Reviews/GIS/Publications (5)
Surface Geology (4)
Subsurface Geology (2)
Core Library (3)
Minerals Geology (1)

Total Geological Survey: 19

Total DMR FTE: 105.5

DEPARTMENT OF MINERAL RESOURCES STAFFING



Years of Service	0-3	4-6	7-10	11-15	16-20	21-25	26-30	30+
FTE	28	20	20.5	15	7	5	2	6
%	19%	19%	20%	14%	7%	5%	2%	6%

DMR STAFF MODEL

	Current			Metrics	FY 2022				FY 2023				Action
	FTE	FT	V / T		Workload	Need	FT	V / T	Workload	Need	FT	V / T	
Pipeline	10.0	10.0		200 miles gathering pipeline construction / FTE	2,000	10.0	10.0		1,930	9.7	10.0		
Underground injection	1.0	1.0		1,500 UIC wells / FTE	1,607	1.1	1.0		1,460	1.0	1.0		
Treating Plants	1.0	1.0		10 permits / year / FTE	10	1.0	1.0		9	0.9	1.0		
Well logs, cores, samples, tops, and surveys	5.0	5.0		500 permits / year / FTE	2,000	4.0	5.0		2,400	4.8	5.0		FY22 reassign 1 to CCUS
Carbon Capture Utilization & Storage (CCUS)	0.0	0.0		2 permits / year / FTE	3	1.3	0.0		2	1.0	0.0		FY22 +1 reassigned
Oil and Gas permitting	5.0	5.0		500 permits new and renewed / year / FTE	2,000	4.0	5.0		2,400	4.8	5.0		FY22 reassign 1 to NC,IA,TA
Information Technology	5.0	5.0		25 employees / FTE	101	4.0	4.0		101	4.0	4.0		1 retiring not replaced
Accounting & payroll	3.0	3.0		33 employees / FTE	101	3.0	3.0		101	3.0	3.0		
Reclamation	2.0	1.0	1.0	9,400 wells / FTE	19,287	2.1	1.0	1.0	19,707	2.1	1.0	1.0	1 vacant need to hire
Petroleum Engineering (NC, IA, TA, Sundries)	2.0	2.0		1,100 wells / FTE	3,500	3.2	2.0		2,250	2.0	2.0		FY22 +1 reassigned
Production auditing	3.0	3.0		6,200 wells / FTE	19,287	3.1	3.0		19,707	3.2	3.0		
Oil and Gas measurement	2.0	2.0	0.5	7,500 wells / FTE	19,287	2.6	2.0	0.5	19,707	2.6	2.0	0.5	
Hearing dockets and orders	2.0	2.0		450 cases / year / FTE	500	1.1	2.0		830	1.8	2.0		FY22 assign 1 to NSTAR
Reception, filing, and PIO	3.5	3.5		5,400 wells & files / FTE	19,287	3.6	3.5		19,707	3.6	3.5		
Human Resources	1.0	1.0		100 employees / FTE	101	1.0	1.0		101	1.0	1.0		
Safety-Facilities-Motorpool	1.0	1.0		100 employees / FTE	101	1.0	1.0		101	1.0	1.0		
Bonding	1.0	1.0		19,000 wells / FTE	19,287	1.0	1.0		19,707	1.0	1.0		
Geology surface	4.0	4.0		22 permits, publications, presentations /year/ FTE	88	4.0	4.0		85	3.9	4.0		
Geology minerals	1.0	1.0		6 permits, publications, presentations /year/ FTE	6	1.0	1.0		6	1.0	1.0		
Geology subsurface	2.0	2.0		7 permits, publications, presentations /year/ FTE	14	2.0	2.0		14	2.0	2.0		
Geology inquiries, georeviews, and publications	5.0	5.0		19 permits, publications, presentations /year/ FTE	75	3.9	4.0		72	3.8	4.0		1 retiring not replaced
Core Library	3.0	3.0	3.0	500 permits / year / FTE	2,000	4.0	3.0	1.0	2,400	4.8	3.0	2.0	UND students as temps
Paleontology	3.0	3.0	0.5	20 permits, publications, presentations /year/ FTE	68	3.5	3.0	0.5	65	3.3	3.0	0.5	
Executive	4.0	4.0		25 employees / FTE	101	4.0	4.0		101	4.0	4.0		
Total Office Staff	**69.5**	**68.5**	**1.0**			69.5	**66.5**	**1.0**		70.5	**66.5**	**1.0**	Fill vacant FTE
			4.0					**2.0**				**3.0**	
Total Field Staff	**36.0**	**26.0**	**10.0**	615.0 wells / FTE	20,900	34.0	**34.0**	**0.0**	20,917	34.0	**34.0**	**0.0**	Fill 7 vacant FTE
Total DMR Staff	**105.5**	**94.5**	**11.0**			103.5	**100.5**	**1.0**		104.5	**100.5**	**1.0**	Fill vacant FTE
			4.0					**2.0**				**3.0**	

Oil and Gas Division

AGENCY OVERVIEW

NORTH DAKOTA OIL AND GAS DIVISION

The Oil and Gas Division, headed by the Director, was formed in 1981 to provide the technical expertise needed for enforcement of Industrial Commission jurisdiction over statutes, rules, regulations, and orders pertaining to geophysical exploration, drilling, production of oil and gas, restoration of drilling and production sites, and proper disposal of oil field brine and other oil field wastes in North Dakota.

The Division facilitates the electronic storage of and provides access to oil and gas production, reservoir, well, and geophysical exploration data for use by industry, royalty owners, and other governmental agencies and citizens.

In 2009, regulation of carbon dioxide storage was added to the Oil and Gas Division responsibilities. In 2013, regulation of underground gathering pipeline infrastructure was added to the Oil and Gas Division's responsibilities. In 2015, this authority was broadened to include bonding requirements on underground gathering pipelines.

OIL AND GAS REGULATORY PROGRAMS

Oil and Gas Exploration and Production (NDCC 38-08)

It is hereby declared to be in the public interest to foster, to encourage, and to promote the development, production, and utilization of natural resources of oil and gas in the state in such a manner as will prevent waste; to authorize and to provide for the operation and development of oil and gas properties in such a manner that a greater ultimate recovery of oil and gas be had and that the correlative rights of all owners be fully protected; and to encourage and to authorize cycling, recycling, pressure maintenance, and secondary recovery operations in order that the greatest possible economic recovery of oil and gas be obtained within the state to the end that the landowners, the royalty owners, the producers, and the general public realize and enjoy the greatest possible good from these vital natural resources.

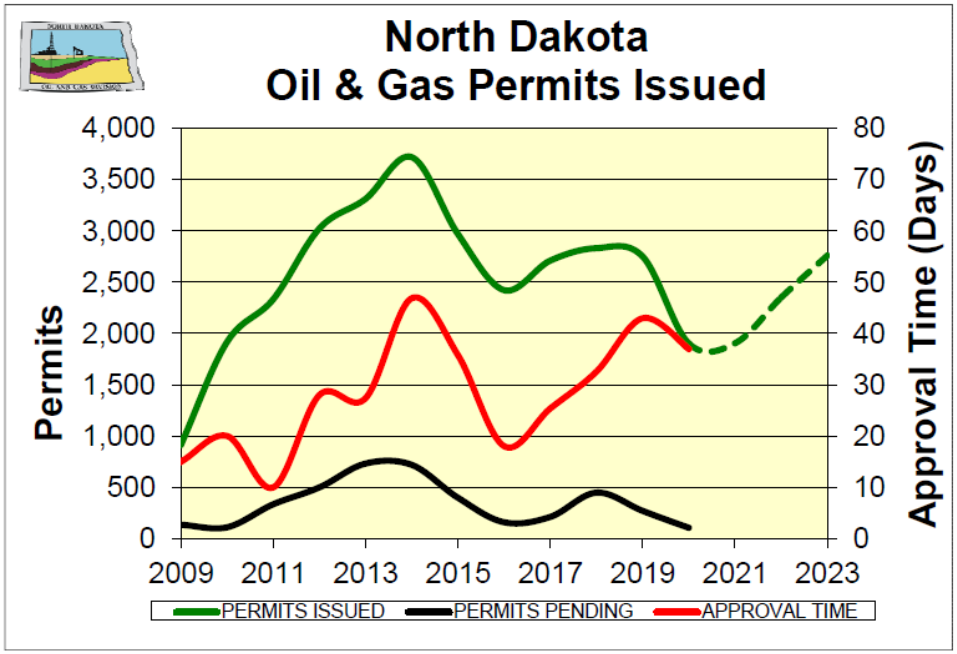
Geophysical Exploration (NDCC 38-08.1)

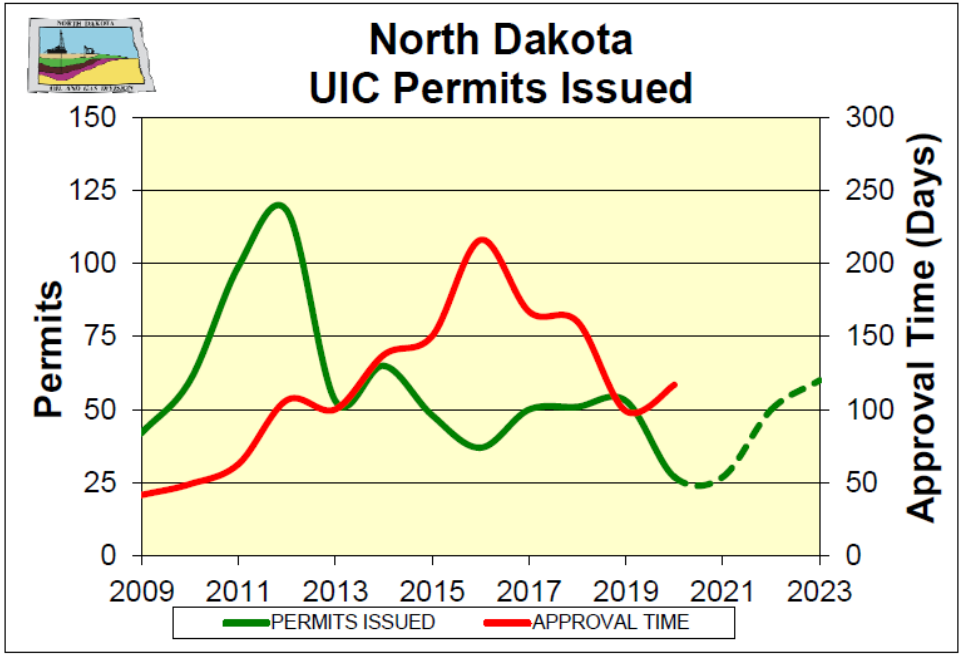
Notwithstanding any other provision of this chapter, the commission is the primary enforcement agency governing geophysical exploration in this state. Any person in this state engaged in geophysical exploration or engaged as a subcontractor of a person engaged in geophysical exploration shall comply with this chapter; provided, however, that compliance with this chapter by a crew or its employer constitutes compliance herewith by that person who has engaged the service of the crew, or its employer, as an independent contractor.

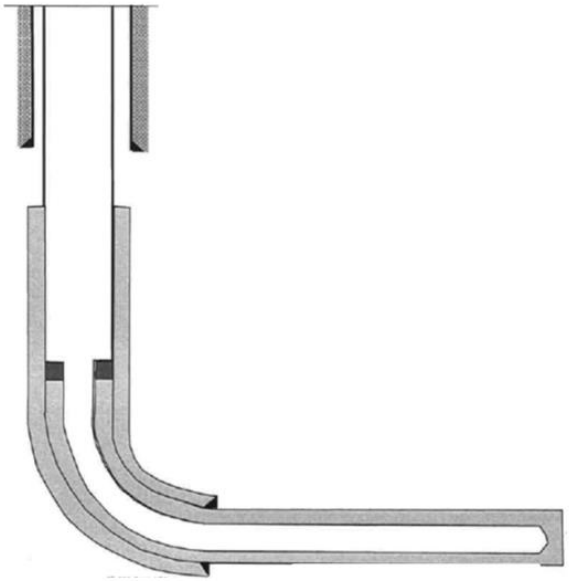
OIL AND GAS REGULATORY PROGRAMS

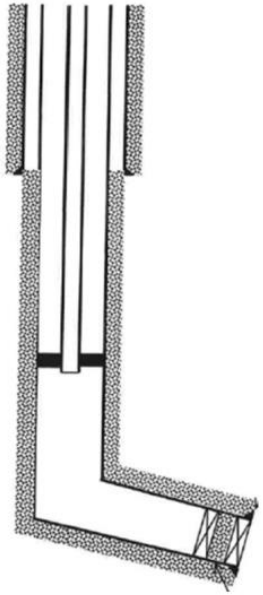
Pipeline (NDCC 38-08-27)
The application of this section is limited to an underground gathering pipeline that is designed or intended to transfer crude oil or produced water from a production facility for disposal, storage, or sale purposes and which was placed into service after August 1, 2015. Upon request, the operator shall provide the commission the underground gathering pipeline engineering construction design drawings and specifications, list of independent inspectors, and a plan for leak protection and monitoring for the underground gathering pipeline. Within sixty days of an underground gathering pipeline being placed into service, the operator of that pipeline shall file with the commission an independent inspector's certificate of hydrostatic or pneumatic testing of the underground gathering pipeline.

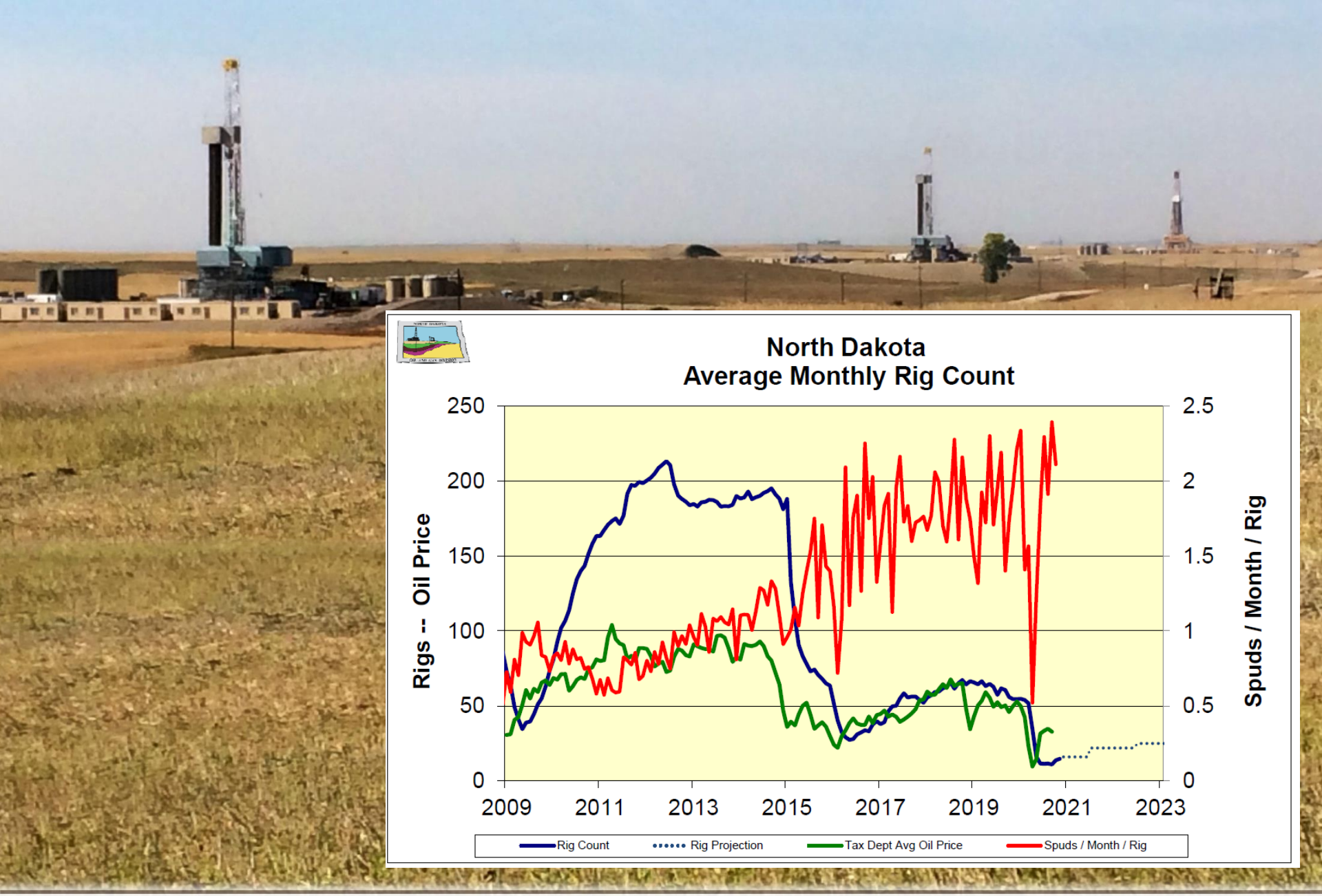
Carbon Dioxide Geological Storage (NDCC 38-22-01)
It is in the public interest to promote the geologic storage of carbon dioxide. Doing so will benefit the state and the global environment by reducing greenhouse gas emissions. Doing so will help ensure the viability of the state's coal and power industries, to the economic benefit of North Dakota and its citizens. Further, geologic storage of carbon dioxide, a potentially valuable commodity, may allow for its ready availability if needed for commercial, industrial, or other uses, including enhanced recovery of oil, gas, and other minerals. Geologic storage, however, to be practical and effective requires cooperative use of surface and subsurface property interests and the collaboration of property owners. Obtaining consent from all owners may not be feasible, requiring procedures that promote, in a manner fair to all interests, cooperative management, thereby ensuring the maximum use of natural resources.


North Dakota
Oil & Gas Permits Issued
Permits
Approval Time (Days)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
80
70
60
50
40
30
20
10
0
2009
2011
2013
2015
2017
2019
2021
2023
PERMITS ISSUED
PERMITS PENDING
APPROVAL TIME

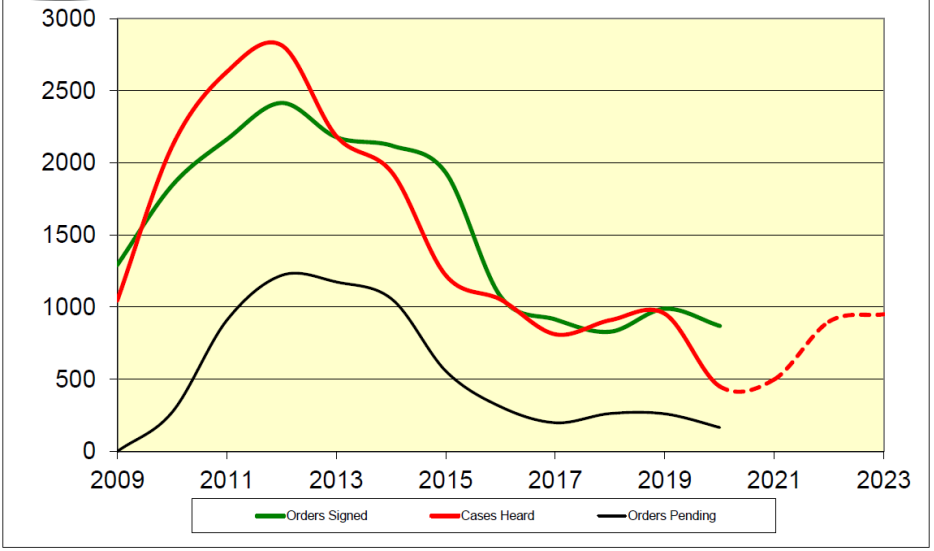

North Dakota
UIC Permits Issued
Permits
Approval Time (Days)
150
125
100
75
50
25
0
300
250
200
150
100
50
0
2009
2011
2013
2015
2017
2019
2021
2023
PERMITS ISSUED
APPROVAL TIME





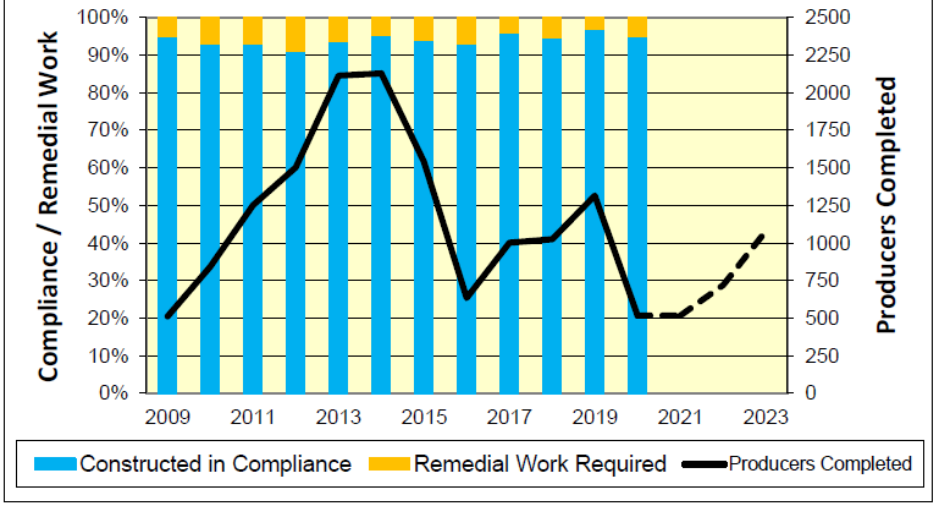

North Dakota
Average Monthly Rig Count
Rigs -- Oil Price
Spuds / Month / Rig
250
200
150
100
50
0
2.5
2
1.5
1
0.5
0
2009
2011
2013
2015
2017
2019
2021
2023
Rig Count
Rig Projection
Tax Dept Avg Oil Price
Spuds / Month / Rig

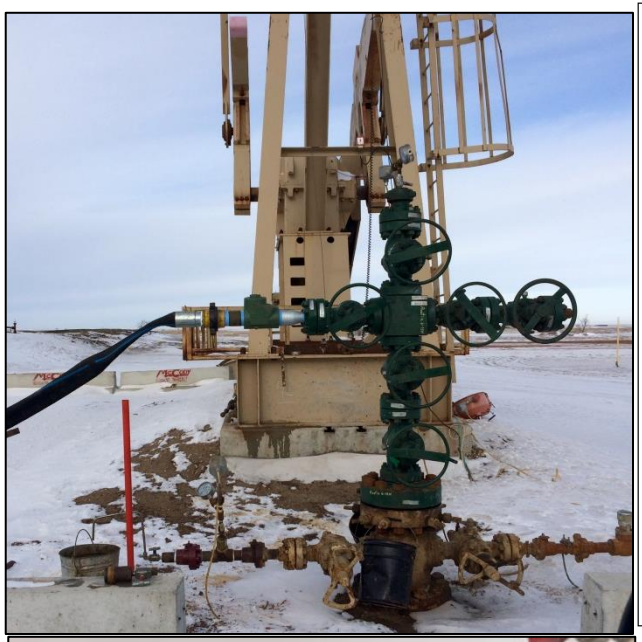
Orders Signed--Cases Heard

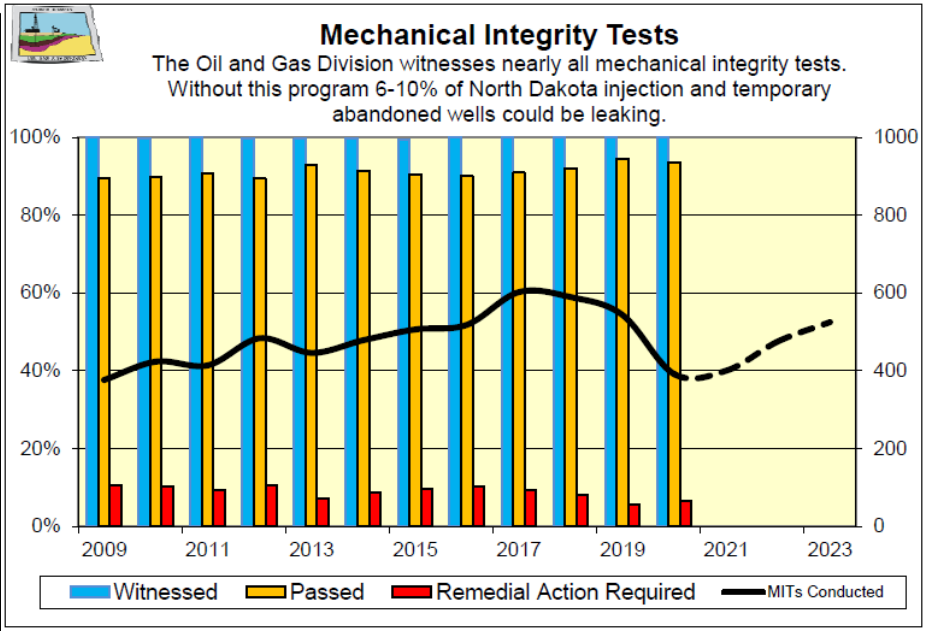


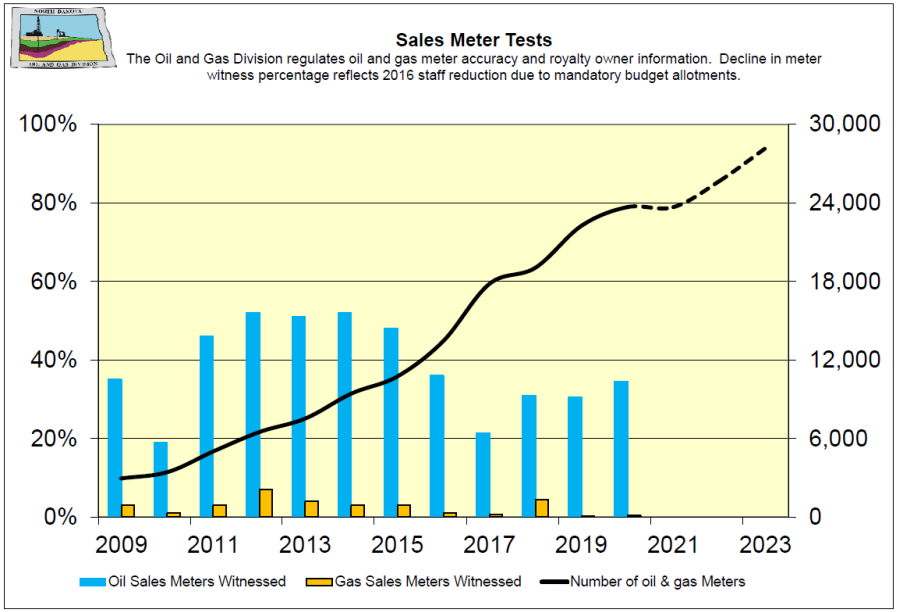
Well Construction

Well construction rules protect underground drinking water.
Without this program 5-10% of new wells could be leaking.



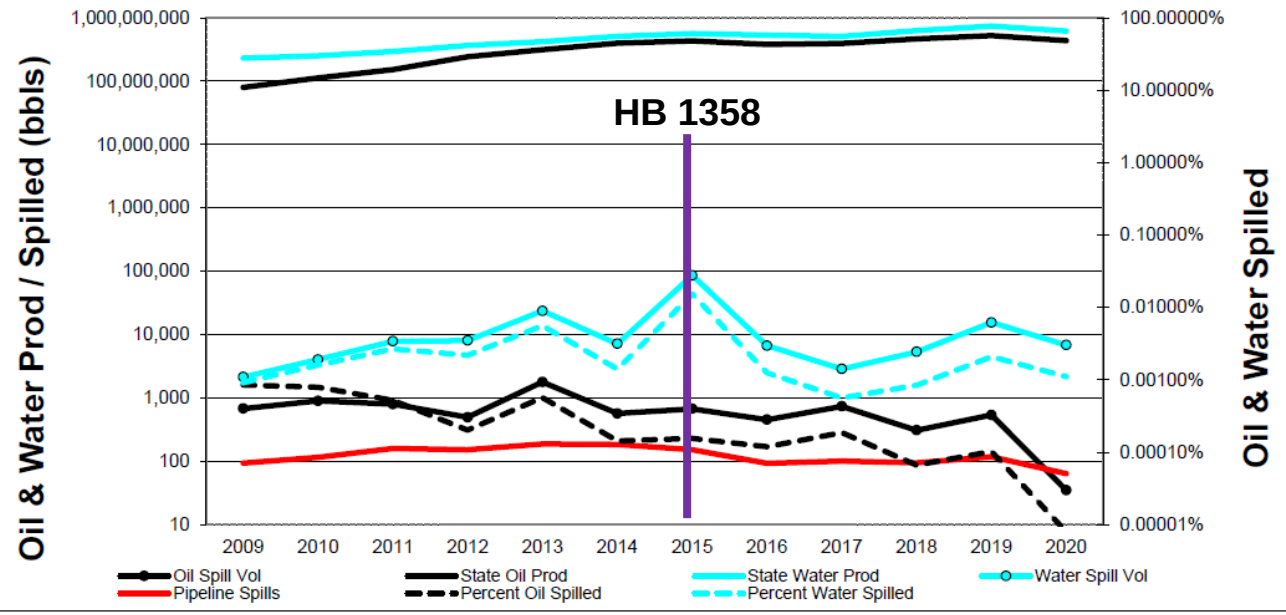



Mechanical Integrity Tests
The Oil and Gas Division witnesses nearly all mechanical integrity tests. Without this program 6-10% of North Dakota injection and temporary abandoned wells could be leaking.
100%
80%
60%
40%
20%
0%
1000
800
600
400
200
0
2009
2011
2013
2015
2017
2019
2021
2023
Witnessed
Passed
Remedial Action Required
MITs Conducted


Sales Meter Tests
The Oil and Gas Division regulates oil and gas meter accuracy and royalty owner information. Decline in meter witness percentage reflects 2016 staff reduction due to mandatory budget allotments.
100%
80%
60%
40%
20%
0%
30,000
24,000
18,000
12,000
6,000
0
2009
2011
2013
2015
2017
2019
2021
2023
Oil Sales Meters Witnessed
Gas Sales Meters Witnessed
Number of oil & gas Meters

Pipeline Spills

The 64th Legislative Assembly mandated the Commission's Pipeline Program with the passage of HB 1358 effective April 20, 2015.



Geological Survey

AGENCY OVERVIEW

NORTH DAKOTA GEOLOGICAL SURVEY

The North Dakota Geological Survey was created by an act of the North Dakota Legislature in 1895. After 126 years, the Survey still serves as the primary source of geological information in the state. Its mission over the years has grown and is now three-fold: to investigate the geology of North Dakota; to administer regulatory programs and act in an advisory capacity to other state agencies; and to provide public service to the people of North Dakota.

The Geological Survey publishes maps and reports on the mineralogical, paleontological, and geochemical resources of North Dakota, including oil and gas, coal, uranium, critical minerals (including the rare earth elements), clay, sand and gravel, volcanic ash, potash and other salts, etc. In addition to the mapping of subsurface resources such as the Inyan Kara Formation for produced water disposal, the Survey is actively mapping landslides throughout the state. Survey publications support the regulatory programs of the Industrial Commission, as well as other state and federal agencies, and assist mineral companies, geotechnical consulting firms, city and county governments, landowners, and citizens of the state.

The Geological Survey and the Oil and Gas Division are in the Department of Mineral Resources and under the North Dakota Industrial Commission. The main office of the Department of Mineral Resources is located at 1016 East Calgary Avenue in Bismarck. The paleontology program of the Geological Survey is housed in the Clarence Johnsrud Paleontology Laboratory in the North Dakota Heritage Center (state museum) on the State Capitol grounds in Bismarck. The North Dakota State Fossil Collection, as well as the State Rock and Mineral Collection, are also housed in the Heritage Center. The North Dakota Geological Survey's Wilson M. Laird Core and Sample Library is located on the University of North Dakota campus in Grand Forks. The facility currently houses 480,000 feet of core and 57,000 boxes of drill cuttings obtained from oil and gas wells.

GEOLOGICAL SURVEY REGULATORY PROGRAMS

Regulation, Development, and Production of Subsurface Minerals (NDCC 38-12)
The exploration, development and production of subsurface minerals requires a permit, basic data to be provided to the state geologist. These regulations cover minerals not included in the oil & gas and coal regulatory programs.

Subsurface Mineral Exploration and Development (NDAC 43-02-02)
Underground Injection Control Program (NDAC 43-02-02.1)
In Situ Leach Mineral Mining Rules (NDAC 43-02-02.2)
Surface Mining–(Non Coal) (NDAC 43-02-02.3)
Solution Mining (NDAC 43-02-02.4)

Coal Exploration (NDCC 38-12.1)
Drilling for coal exploration or evaluation requires a permit and a report of findings must be filed with the state geologist. Collectively, these reports comprise a database useful to private and government coal researchers and provide information necessary for geologic correlations and economic forecasting.

Coal Exploration (NDAC 43-02-01)

Geothermal Resource Development Regulation (NDCC 38-19)
Geothermal (ground source) heating and cooling systems require a permit. The permit review process helps to ensure that geothermal systems are properly designed and constructed, in order to minimize the risk of groundwater contamination or other environmental problems.

Geothermal Energy Production (NDAC 43-02-07)
Geothermal Deep Energy Production (NDAC 43-02-07.1)

GEOLOGICAL SURVEY REGULATORY PROGRAMS

Paleontological Resource Protection (NDCC 54-17.3)
Paleontological resources, on land owned by the State of North Dakota and its political subdivisions, are protected. A permit is required from the state geologist to investigate, excavate, collect, or otherwise record paleontological resources on these lands.

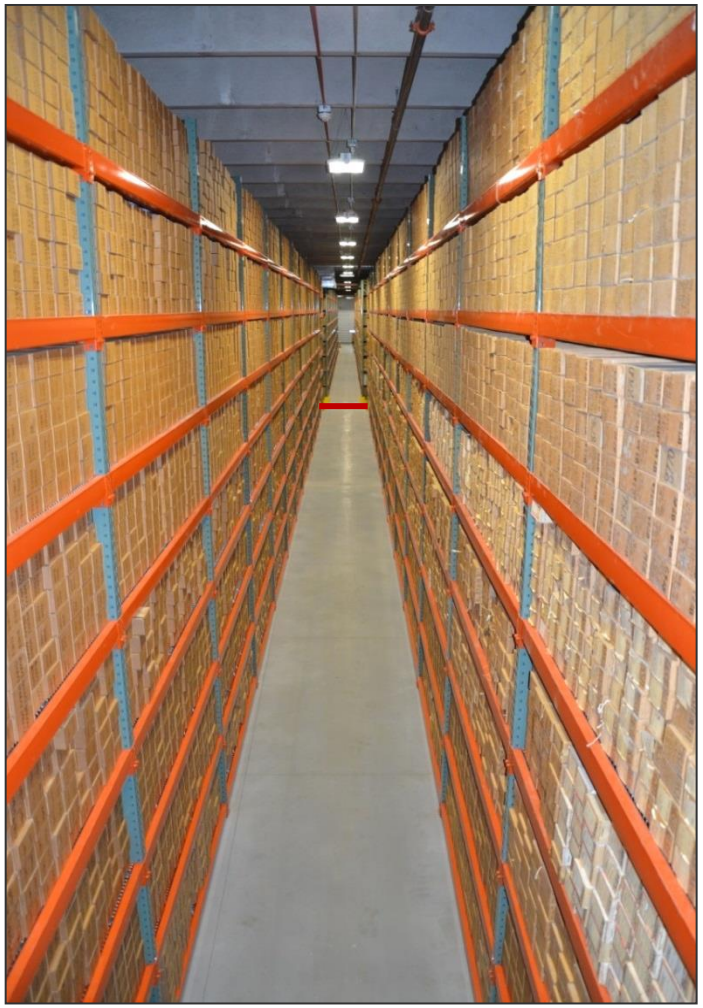
Paleontological Resource Protection (NDAC 43-04-02)

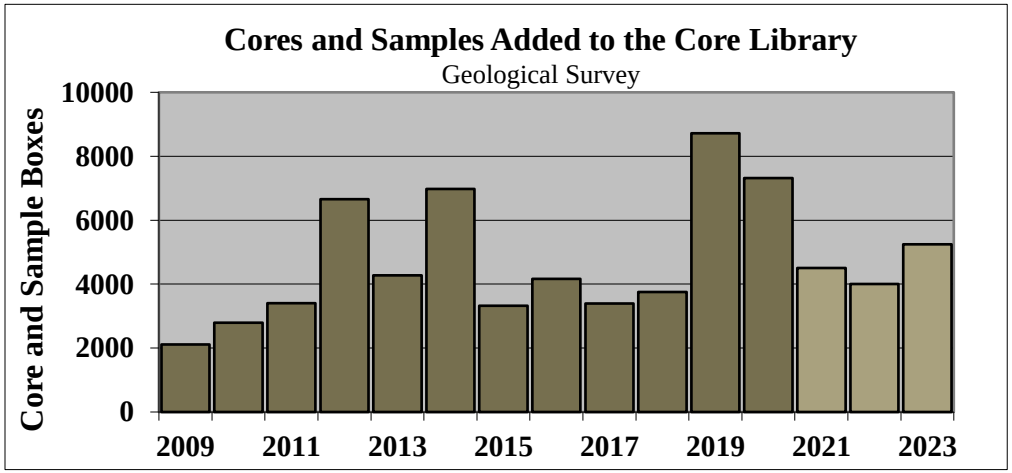
High-Level Radioactive Waste Disposal (NDCC 38-23)
The exploration, testing, placement, storage, or disposal of high-level radioactive waste is prohibited in North Dakota. If this prohibition is struck from the law, a permit is required before any testing, exploring, excavating, drilling, boring or operating of a high-level radioactive waste facility can commence.

High-Level Radioactive Waste (NDAC 43-02-13)

Underground Storage and Retrieval of Nonhydrocarbons (NDCC 38-24)
A permit is required for the testing, storage, or retrieval of nonhydrocarbons and other gases not regulated by title 38.

WILSON M. LAIRD CORE AND SAMPLE LIBRARY





Upper Left: Expansion of the Wilson M. Laird Core and Sample Library was completed in 2016. Right: The core library contains 57,000 sample boxes and 164,000 core boxes. Lower left: Slightly more than 16,000 core and sample (3 ft.) boxes were received into the core library in 2019 and 2020 (equal to all of the boxes on both sides of the aisle down to the red line on the floor in the above photo).

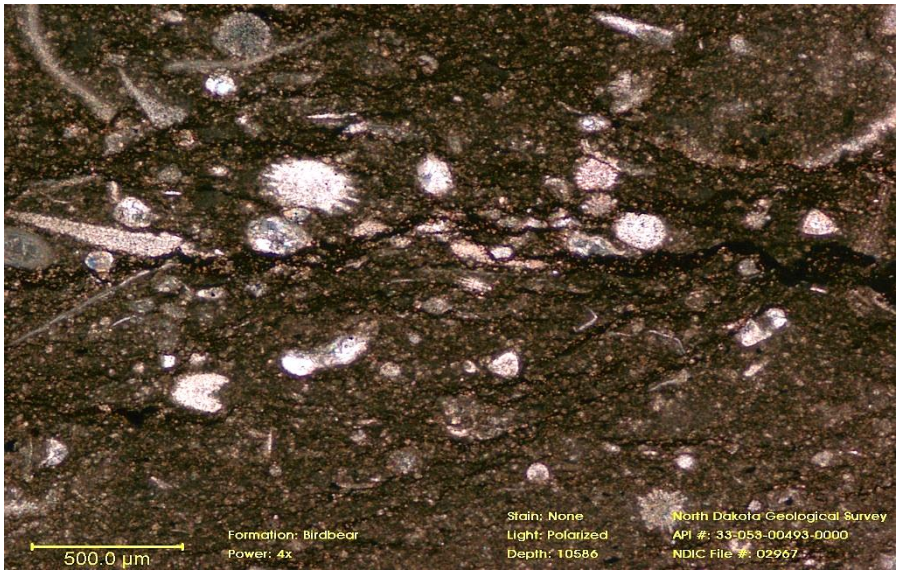
WILSON M. LAIRD CORE AND SAMPLE LIBRARY

Core of the Birdbear Formation at a depth of 9,946 feet in Williams County.

Total core in the core library = 480,208 feet (91 mi.)
Total photographed = 189,222 feet
Core photographs = 290,992

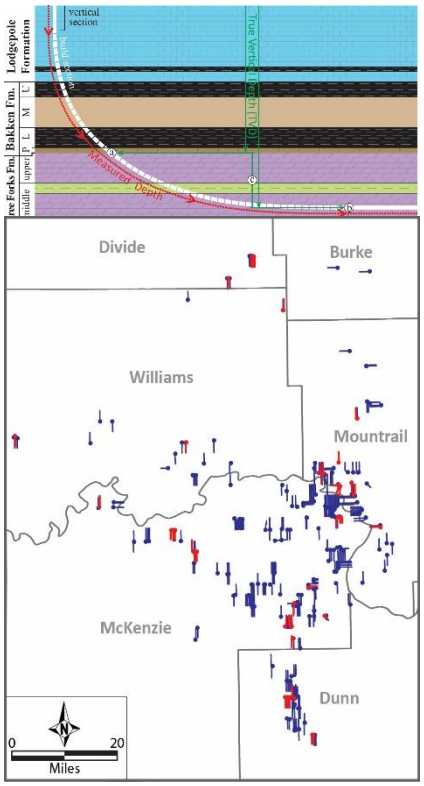
Total thin sections in the core library = 18,611
Thin section photographs = 143,252

Total photographs on website = 434,244

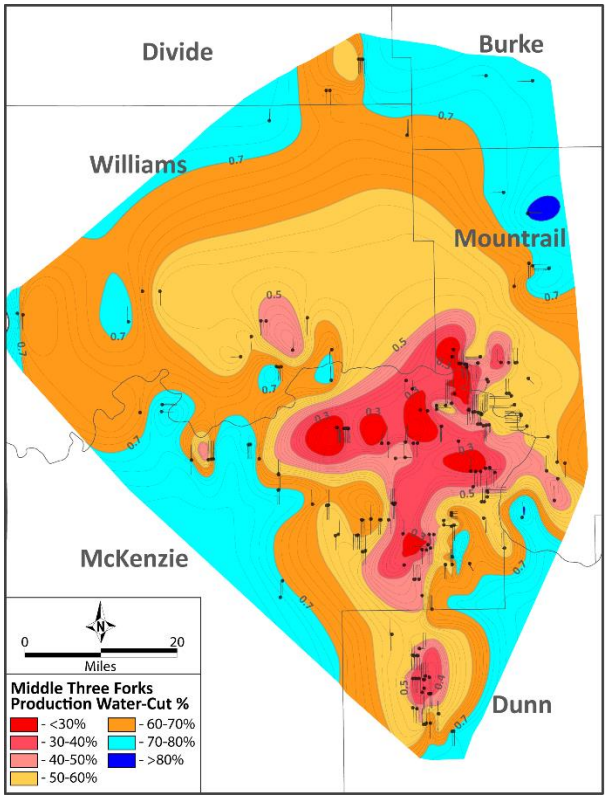


The upper left quadrant of a thin section of core from the Birdbear Formation at a depth of 10,586 feet in McKenzie County.

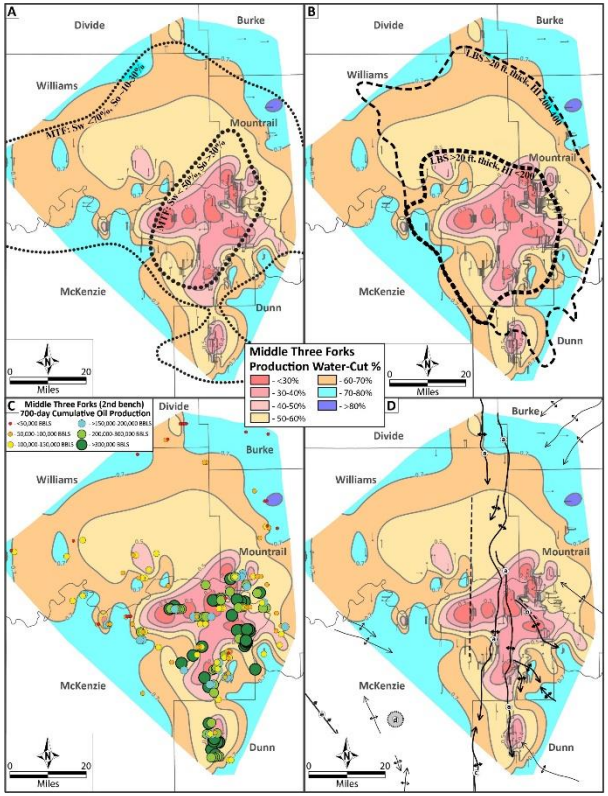
MIDDLE AND LOWER THREE FORKS HORIZONTAL WELLS



A total of 331 horizontal middle (288 - Blue) and lower (43 - Red) horizontal Three Forks wells were examined and validated using a multi-step evaluation process.

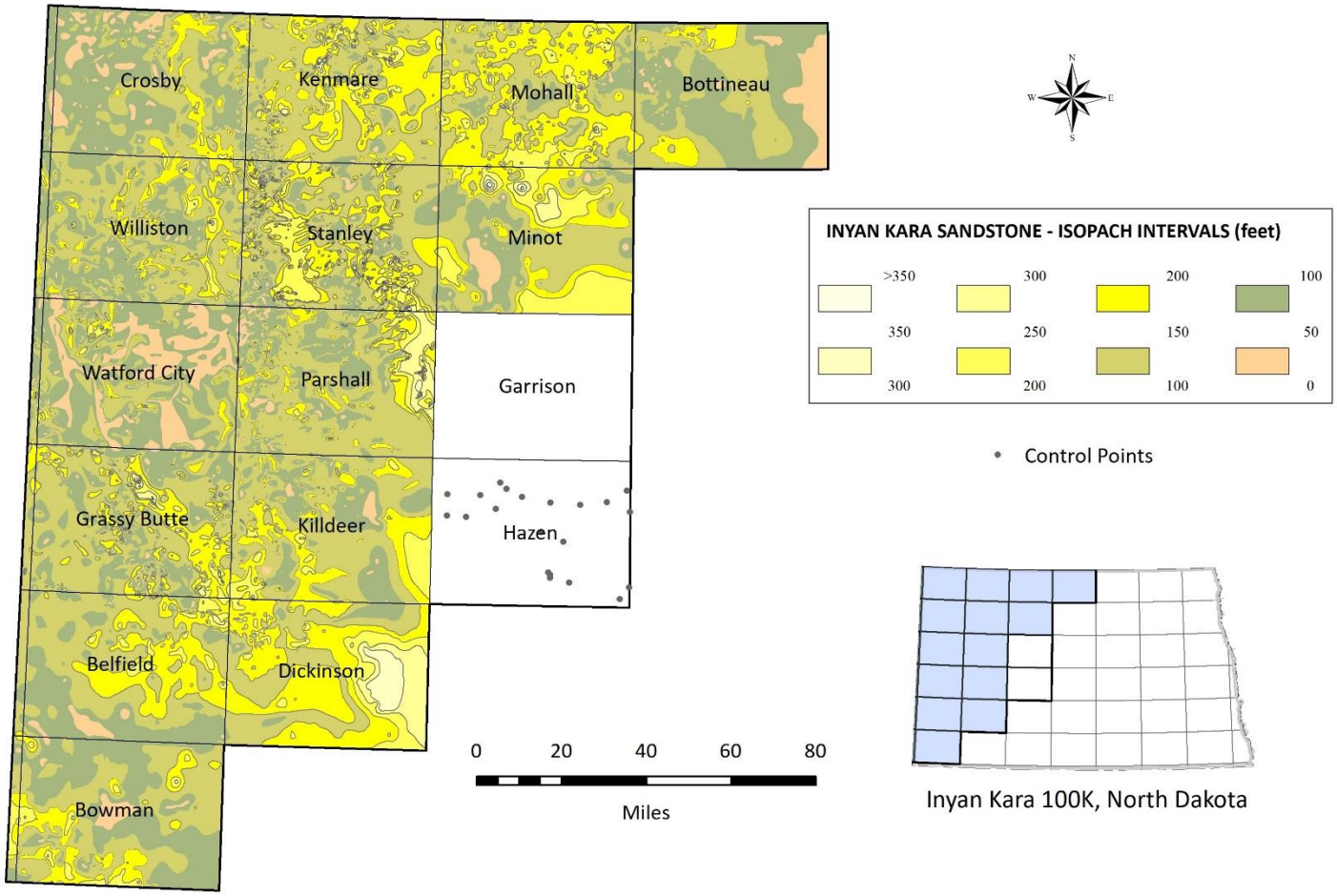


Oil-water ratios (water-cut) from well production data was evaluated and mapped to determine the most oil-productive area(s) for both units (middle Three Forks, 2nd bench, water-cut map pictured above).



Water-cut was evaluated versus multiple other geologic factors (oil saturations from core, oil generation, oil production, and geologic structures).

INYAN KARA FORMATION (saltwater disposal)

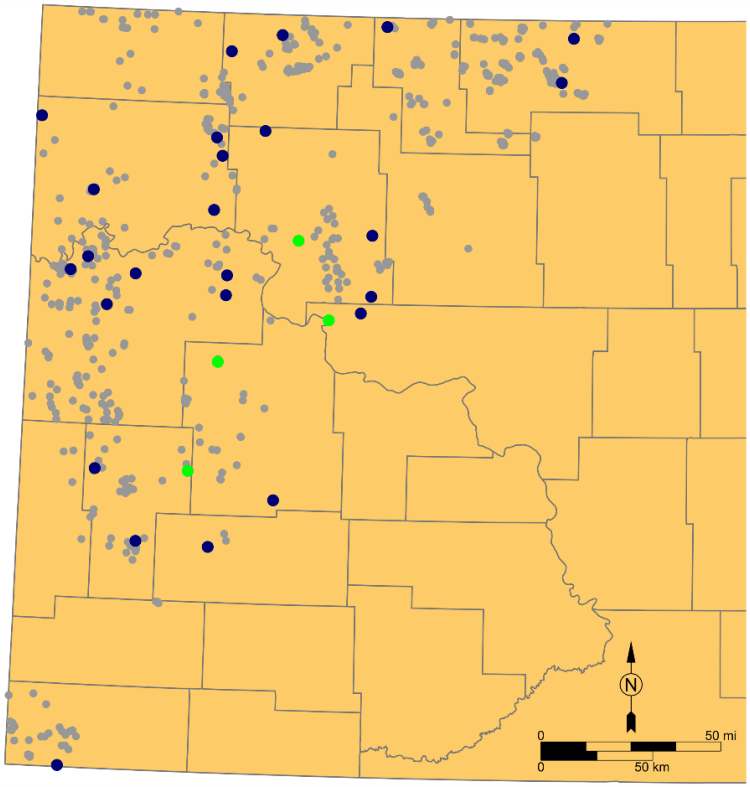


Survey geologists began constructing 1:100,000 scale maps of the Inyan Kara Formation (Dakota Group) in 2015. These maps highlight the areas of greater cumulative sandstone thicknesses (bright yellow) in contrast to the areas containing less sandstone (brown, green, and pink) to assist companies in choosing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

TEMPERATURE LOGGING TEMPORARILY ABANDONED OIL WELLS

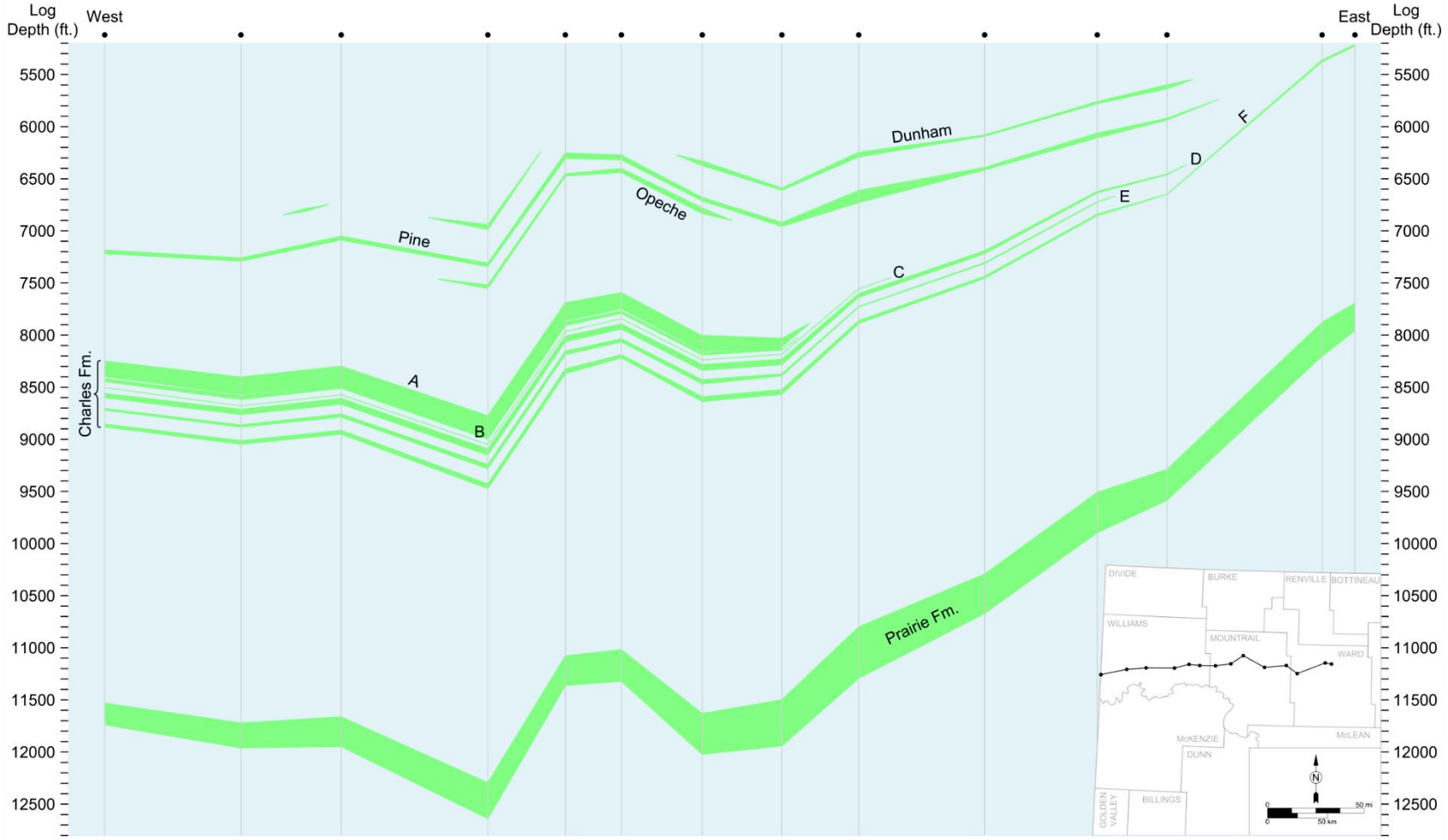
We have temperature logged 29 temporarily abandoned oil wells under this project, generating the most accurate temperature data in the Williston Basin. The data has been used to generate:

1) More accurate heat flow maps for the basin.
2) Thermal maturity maps of the oil-bearing rocks.
3) Geothermal energy potential maps of the basin.



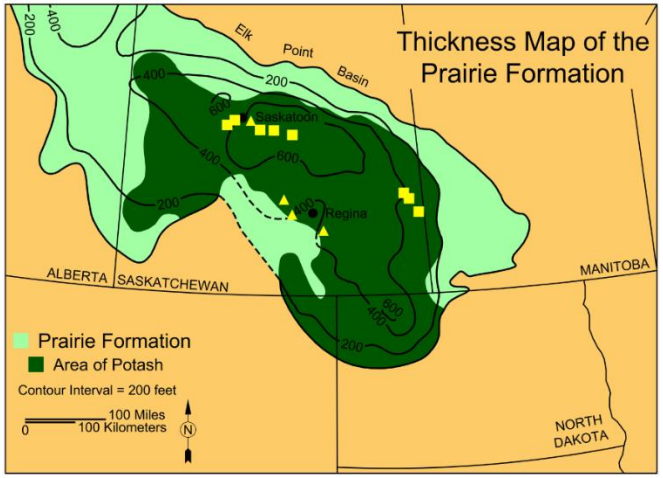
Left: Black dots are wells we have temperature logged, green dots are wells that were temperature logged January 4-7, 2021, and the gray dots are TA'd wells that are potential candidates for logging. Right: Temperature probe being dropped into a TA'd well via a slick line truck.

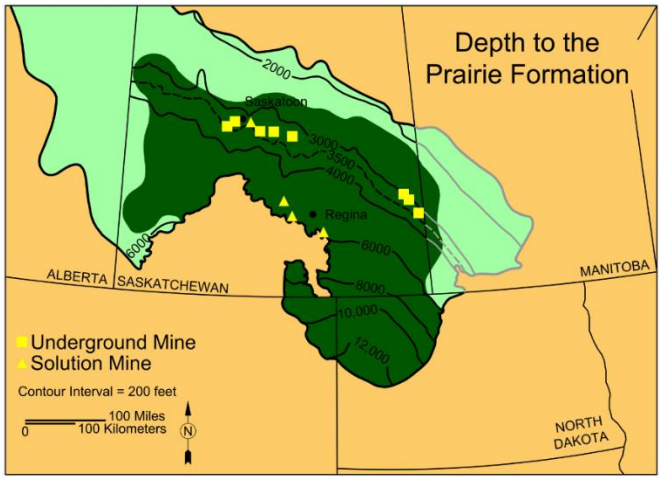
SALT LAYERS IN NORTH DAKOTA

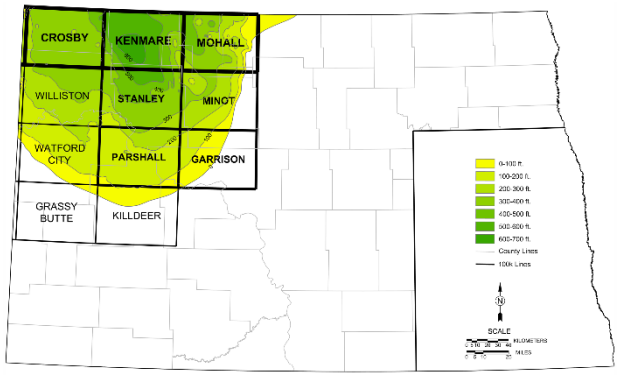


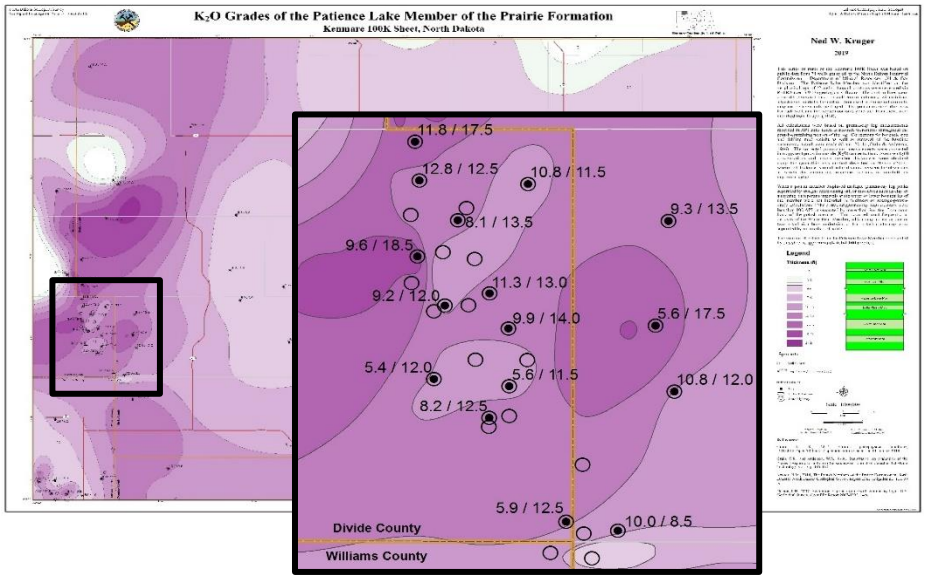
This biennium, Survey geologists mapped both the shallowest salts (Dunham, Pine, and Opeche) and the deepest salt layer in the Williston Basin (the Prairie Formation) for hydrocarbon storage potential and (in regards to the Prairie Formation) potash potential.

PRAIRIE FORMATION (potash -- potassium salts)





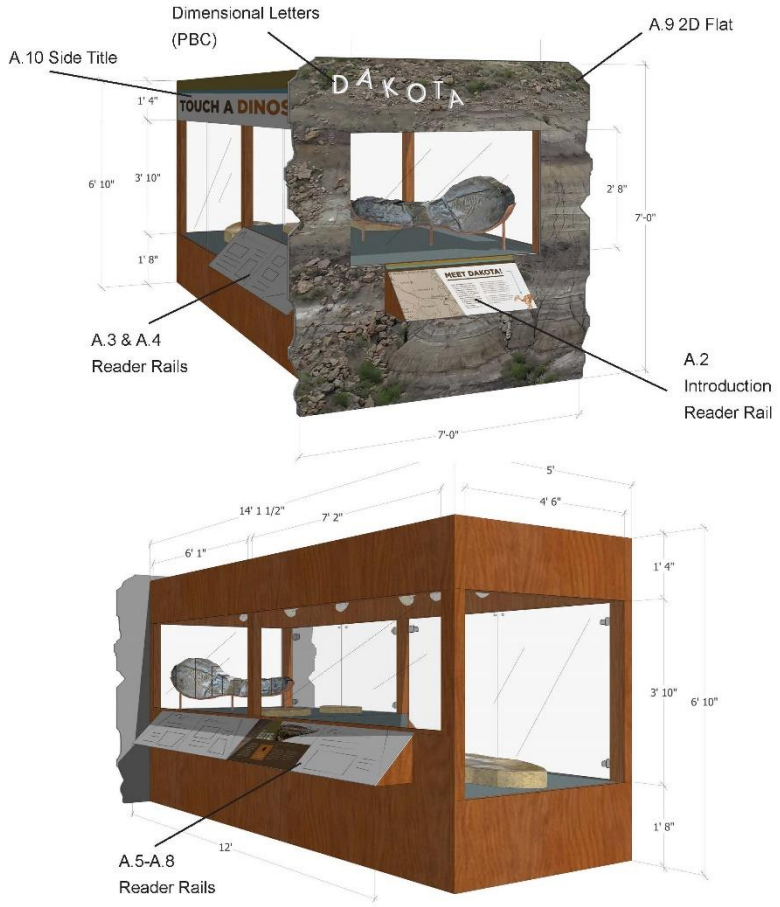




Left: Depth and thickness maps for the Prairie Formation. There are 12 potash mines operating in Saskatchewan. Upper right: We have generated seven, 100K depth and thickness maps of the Prairie Formation (bold outline). In addition, for three of these (Crosby, Kenmare, and Mohall) we have also compiled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

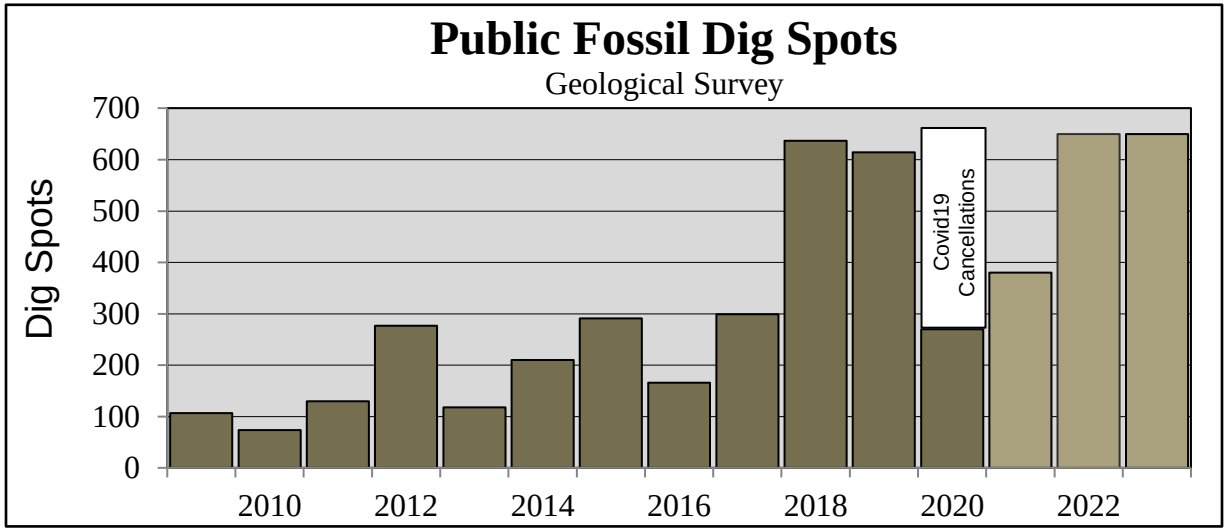
MUMMIFIED HADROSAUR (DAKOTA) EXHIBIT

Exhibit to Open in 2021



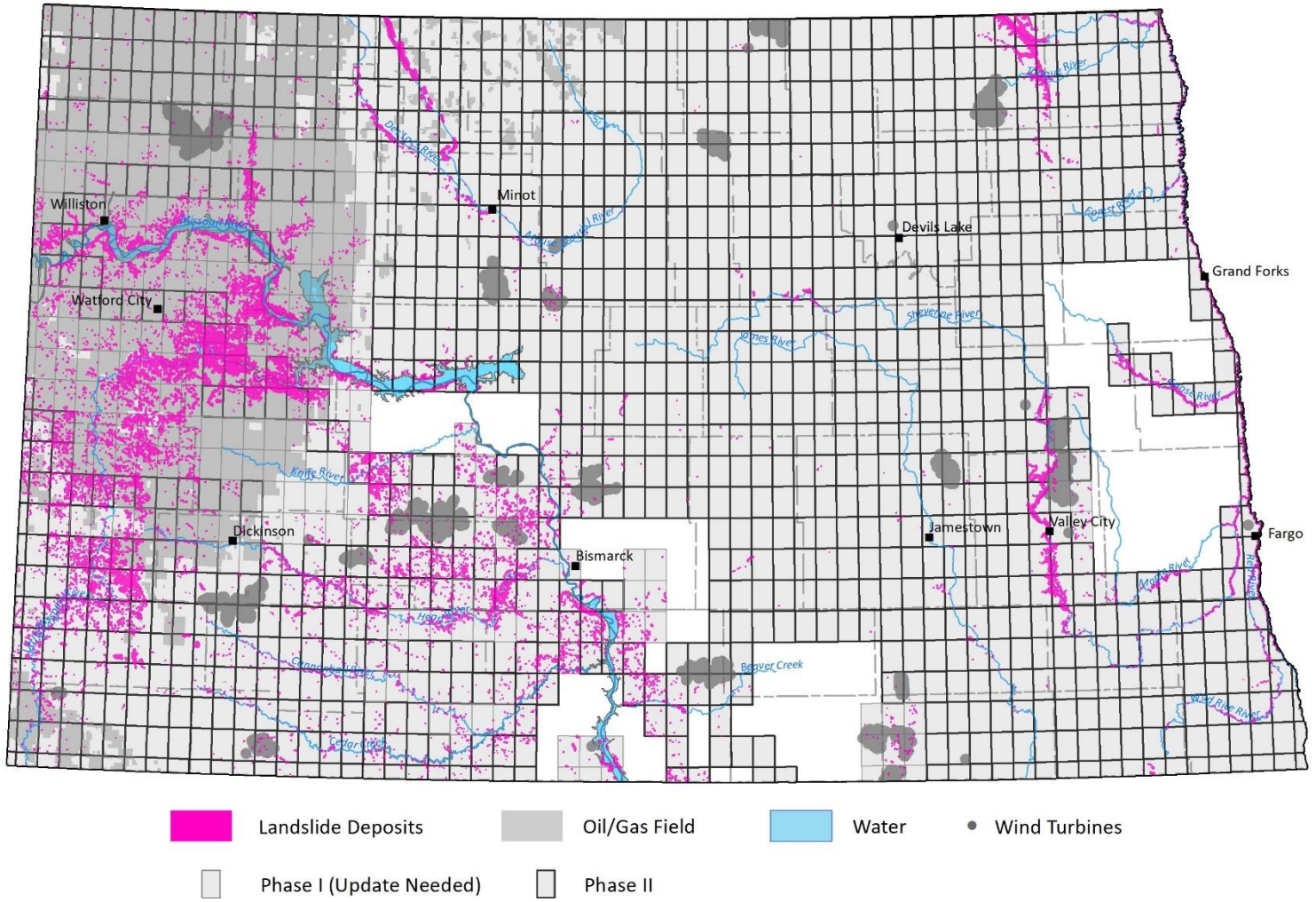
Left: Design drawings for the upcoming Dakota Exhibit in the Heritage Center and State Museum. The exhibit will house the tail, a foot, and an arm of Dakota. Right: Scales and wrinkles are visible on the preserved skin of one of Dakota's arms. The skin appears to have been pealed back by a predator or scavenger. Teeth marks are evident in other parts of the skin.

PUBLIC FOSSIL DIG PROGRAM



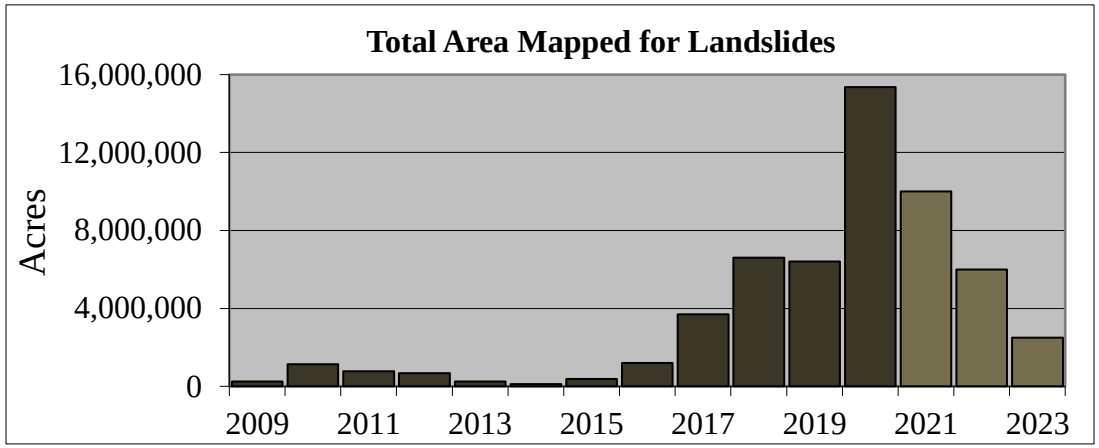
Left: Some of the participants at the 2020 Pembina digging in the Pierre Formation. Right: Part of a jaw (the finger is pointing to it) and bones from a six-foot-long, 80-million-year-old, saltwater-fish uncovered at the 2020 Pembina dig.

LANDSLIDE MAPPING PROGRAM



This biennium we mapped 11,000 landslides over an area of 23 million acres (project total = 31,900 landslides over 43 million acres). For the Phase I maps, only aerial photographs were used to identify landslides while Phase II also used GoogleEarth images, and LiDAR.

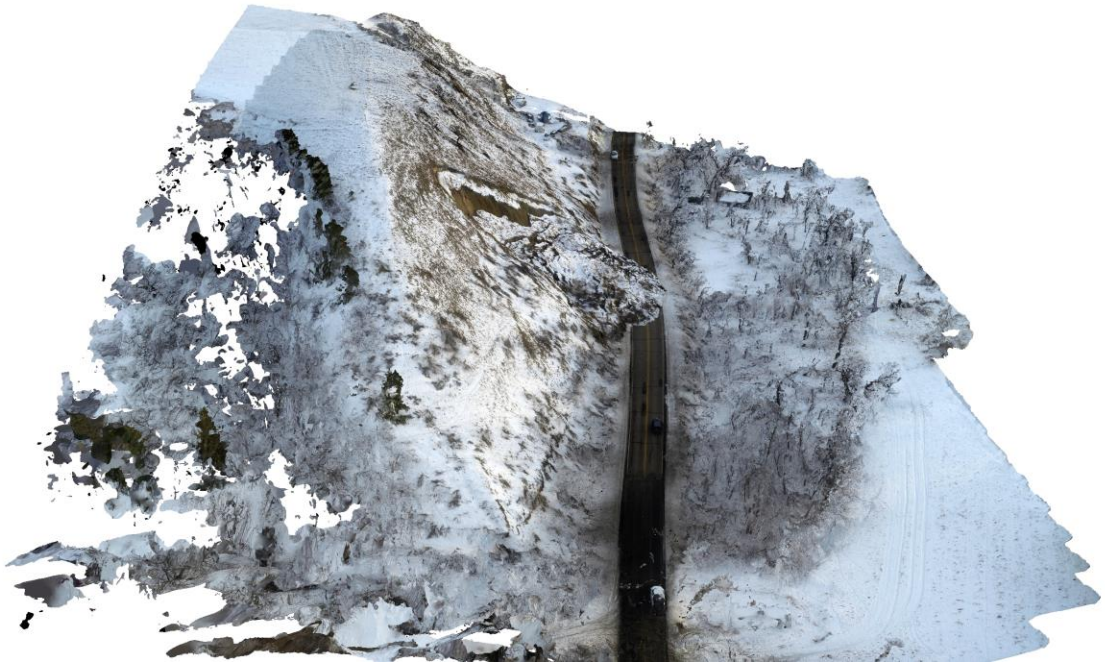
LANDSLIDE MAPPING PROGRAM



Top: Survey geologists mapped more than 23 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.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

River Road Landslide, December 22, 2019

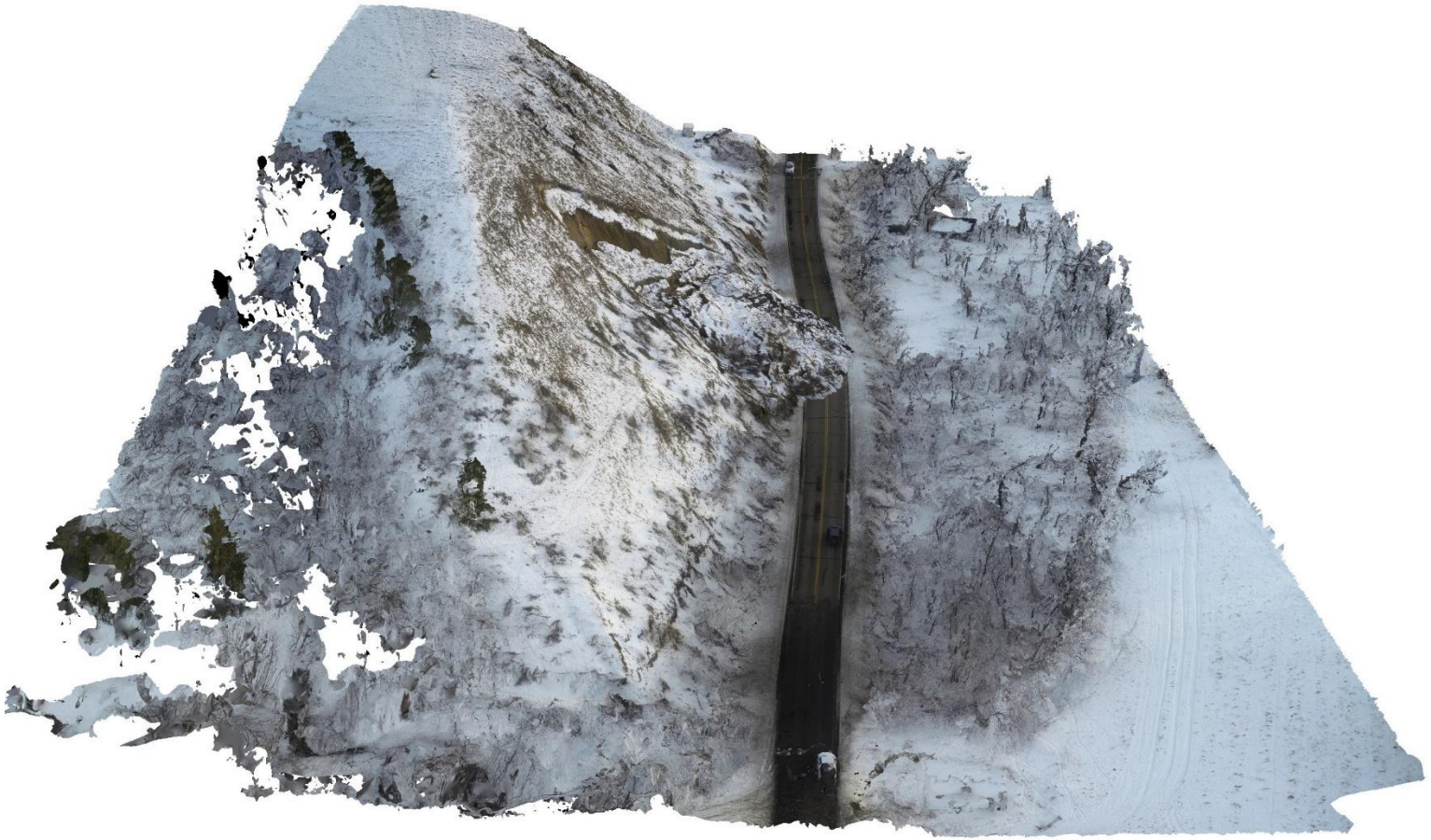


Drone-based 3D Modeling Animation

Photogrammetric model of surface from 150 overlapping drone photos flown at an altitude of 200 feet.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

River Road Landslide, December 22, 2019

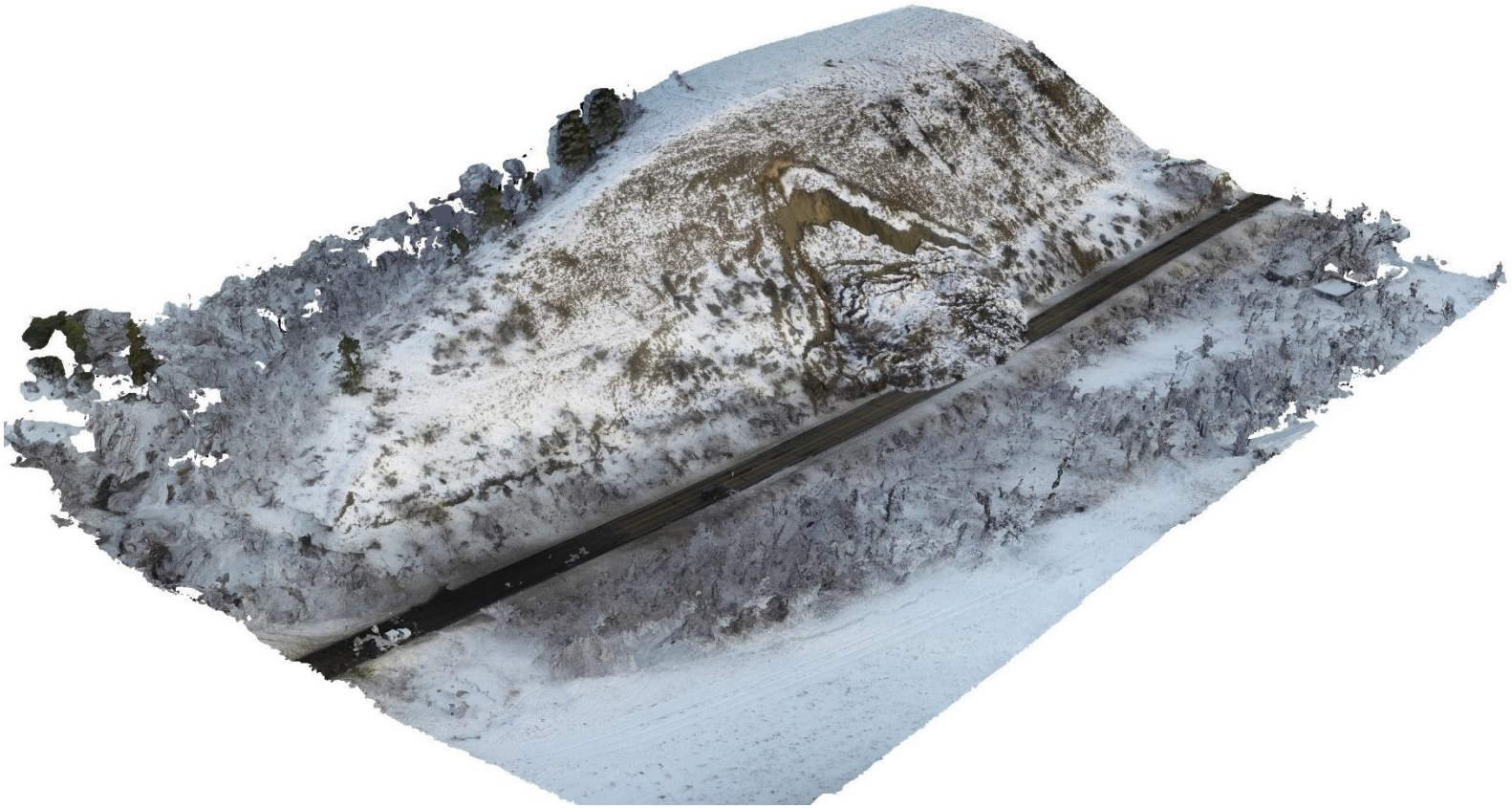


Drone-based 3D Modeling Image

Photogrammetric model of surface from 150 overlapping drone photos flown at an altitude of 200 feet.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

River Road Landslide, December 22, 2019



Drone-based 3D Modeling Image

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GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

River Road Landslide, December 22, 2019

Drone-based 3D Modeling Image

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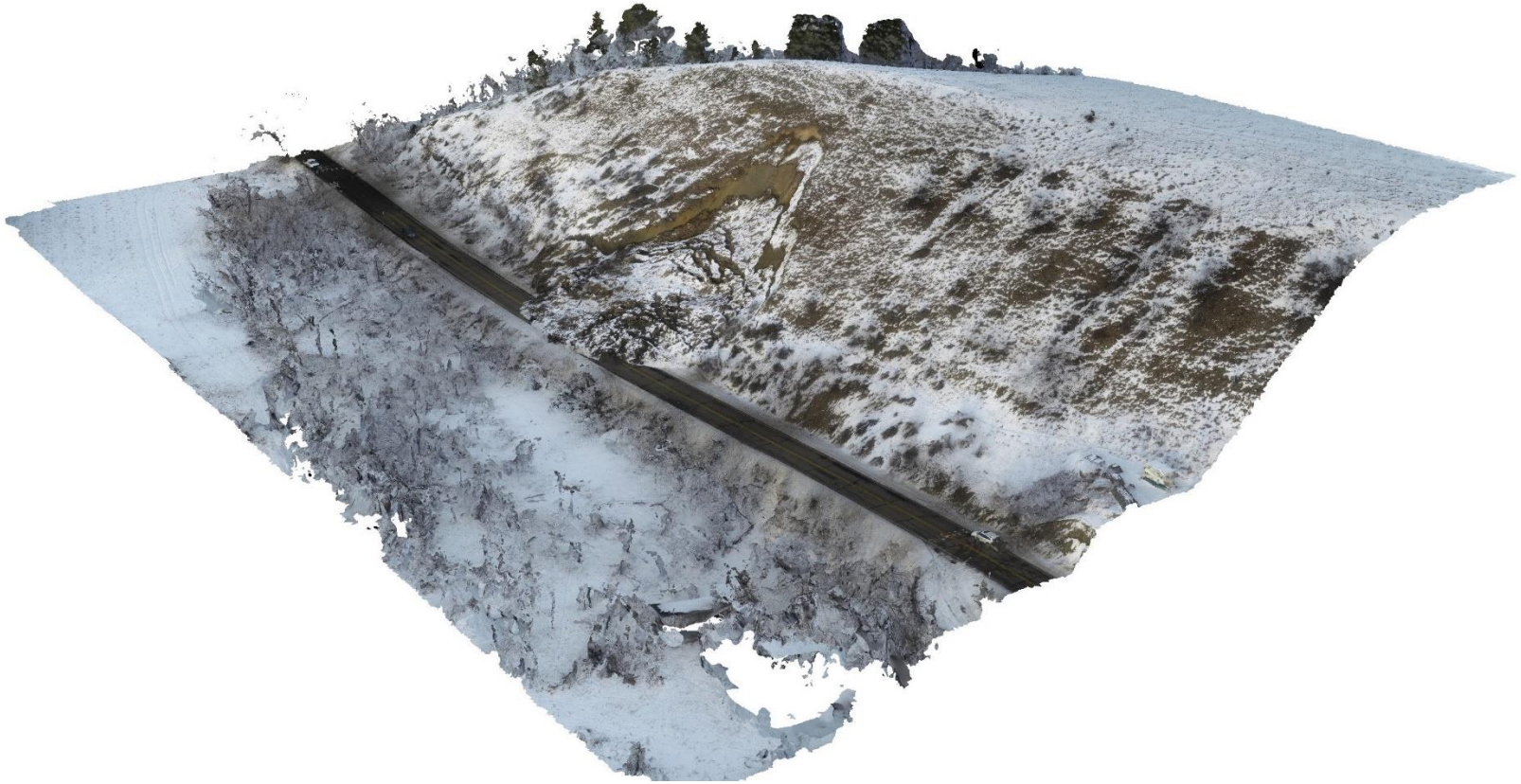
GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

River Road Landslide, December 22, 2019

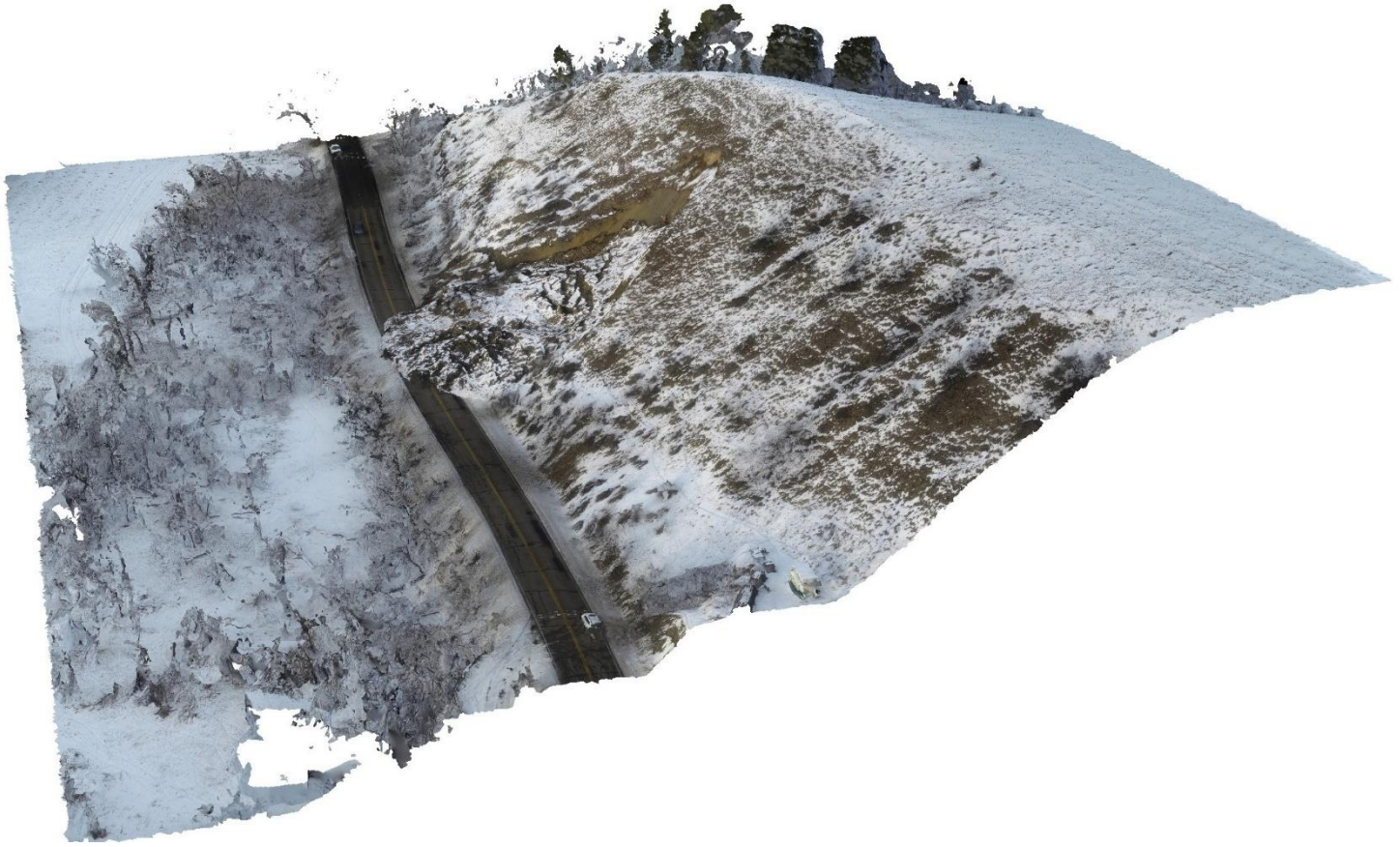


Drone-based 3D Modeling Image

Photogrammetric model of surface from 150 overlapping drone photos flown at an altitude of 200 feet.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

River Road Landslide, December 22, 2019



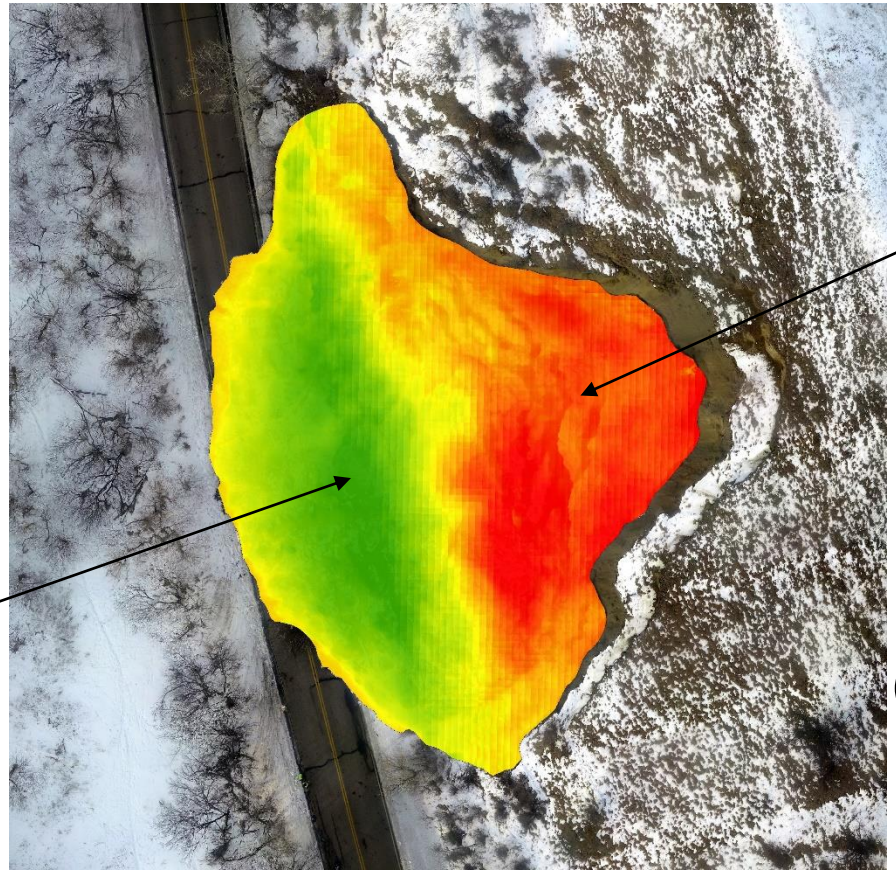
Drone-based 3D Modeling Image

Photogrammetric model of surface from 150 overlapping drone photos flown at an altitude of 200 feet.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

December 22, 2019 River Road Landslide

Drone-based 3D Modeling (**Elevation Changes to the Pre-Landslide Surface**)



15.1 foot drop in elevation.

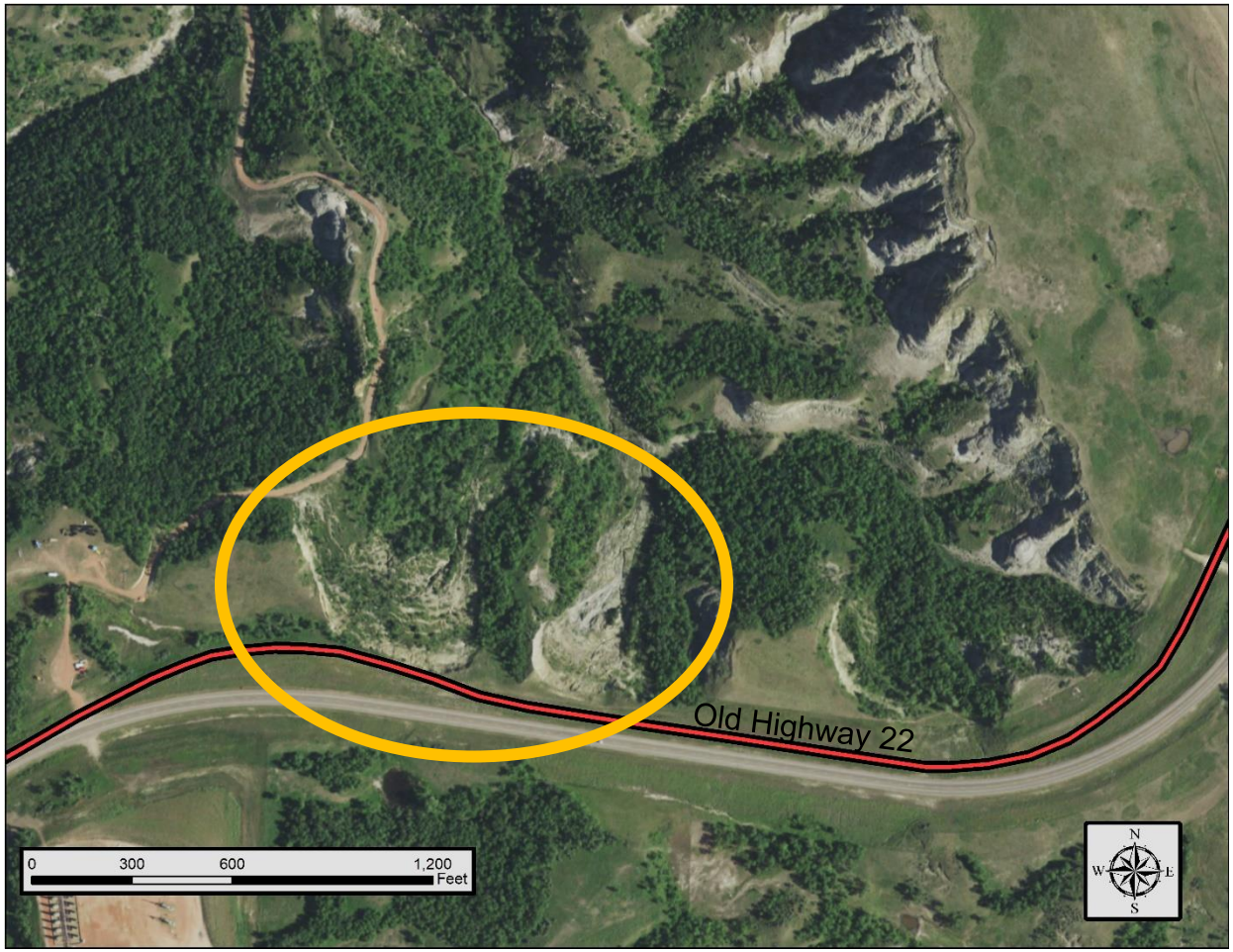
25.6 foot increase in elevation (slide material).

3,480 cubic yards (4,392 tons) of rock on the roadway.

This image was created by comparing the December 22, 2019 drone surface elevation model to the 2016 LiDAR surface elevations. The color image depicts the areas where the elevation decreased (landslide head in red) and where it increased (landslide toe in greens and yellows). The darker the color, the greater the elevation change.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

ND Highway 22 Landslides



A 2020 aerial photograph showing the present-day position of ND Highway 22 and the position of Hwy 22 in 1957 (in red). Encroaching landslides from the north forced the highway to be relocated to the south 100 feet or so in 2011.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

ND Highway 22 Landslides, October 8, 2019

Drone-based 3D Modeling Animation

Photogrammetric model of surface from 1,350 overlapping drone photos flown at an altitude of 200 feet.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

ND Highway 22 Landslides, October 8, 2019

Drone-based 3D Modeling Image

Photogrammetric model of surface from 1,350 overlapping drone photos flown at an altitude of 200 feet.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

ND Highway 22 Landslides, October 8, 2019

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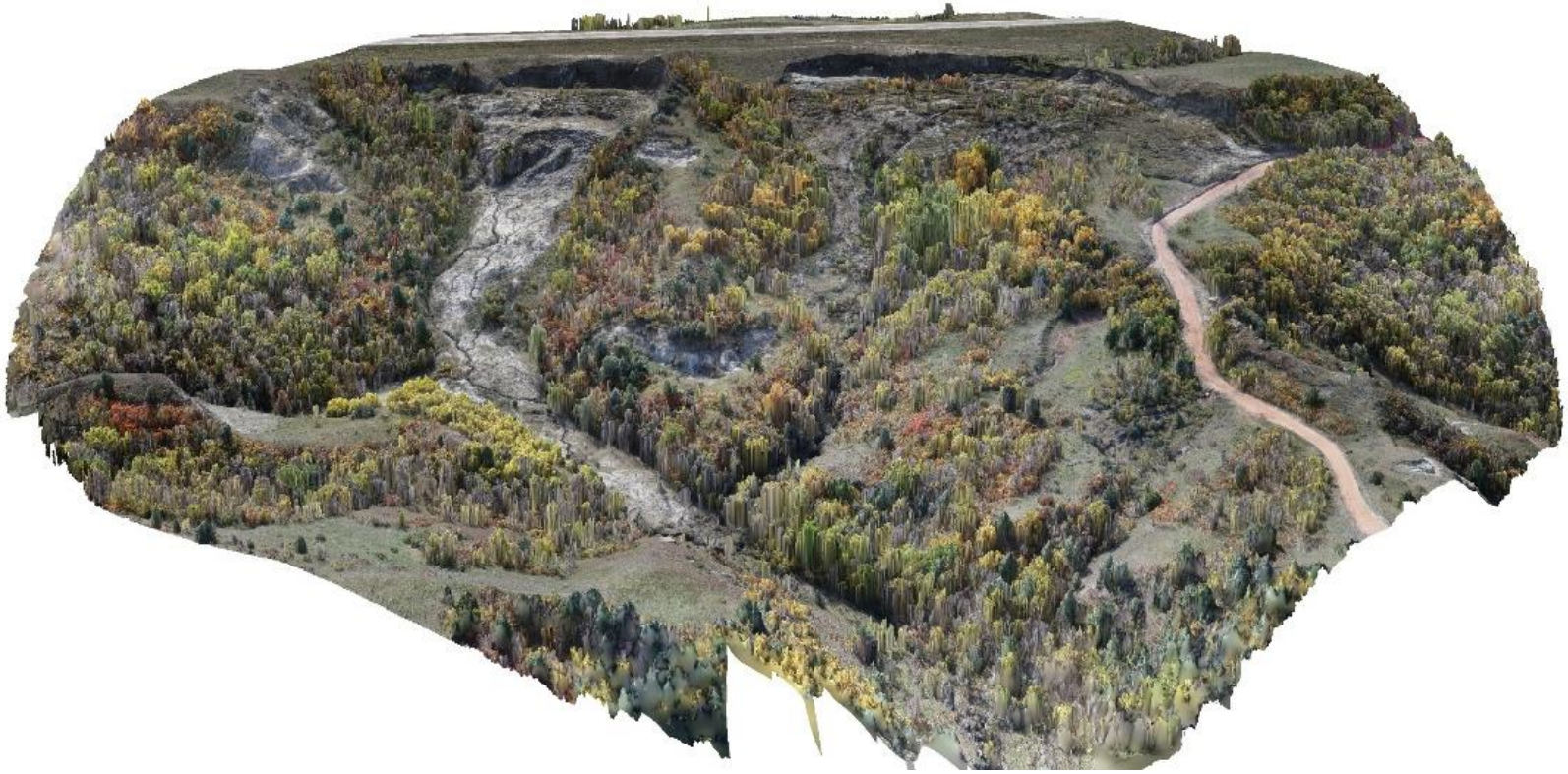
Photogrammetric model of surface from 1,350 overlapping drone photos flown at an altitude of 200 feet.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

ND Highway 22 Landslides, October 8, 2019



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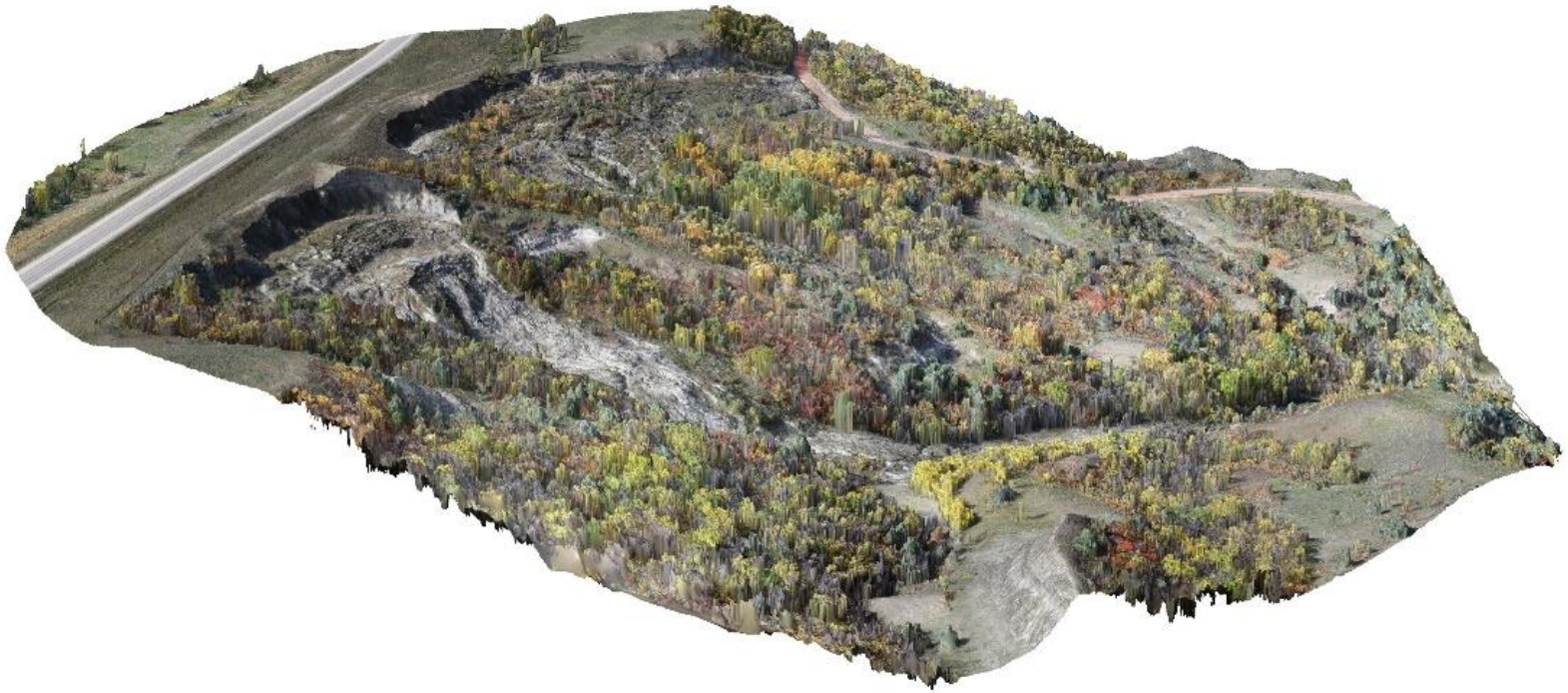
Photogrammetric model of surface from 1,350 overlapping drone photos flown at an altitude of 200 feet.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

ND Highway 22 Landslides, October 8, 2019



Drone-based 3D Modeling Image

Photogrammetric model of surface from 1,350 overlapping drone photos flown at an altitude of 200 feet.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

ND Highway 22 Landslides, October 8, 2019

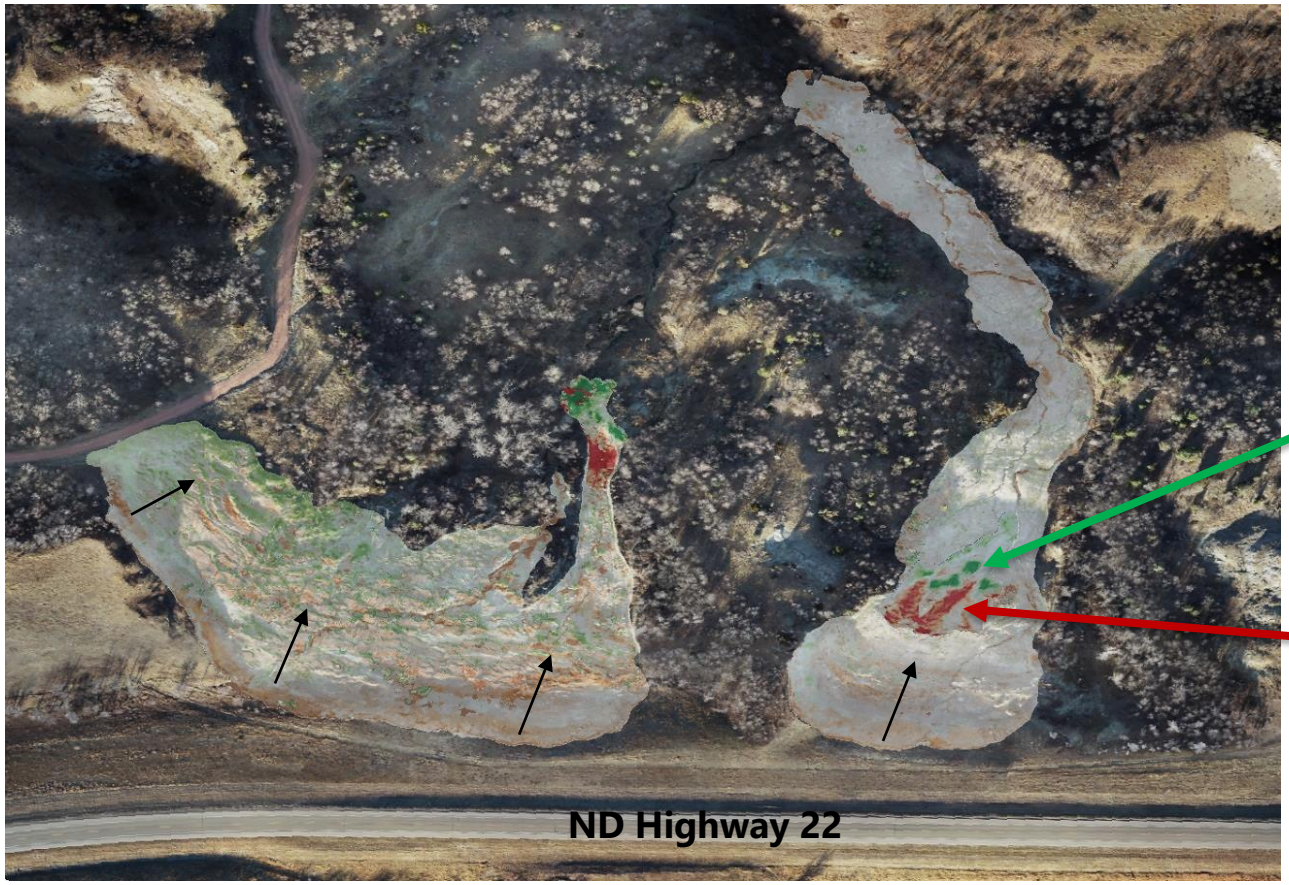
Drone-based 3D Modeling Image

Photogrammetric model of surface from 1,350 overlapping drone photos flown at an altitude of 200 feet.

GEOLOGICAL SURVEY LANDSLIDE INVESTIGATIONS

ND Highway 22 Landslides

Drone-based 3D Modeling **Elevation Changes** (October 2019 to November 2020)



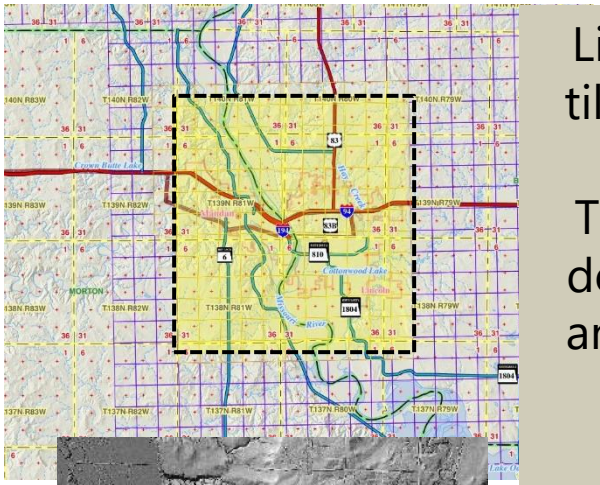
MOVEMENT WITHIN THE LANDSLIDE

5.2 foot positive elevation change

4.3 foot negative elevation change

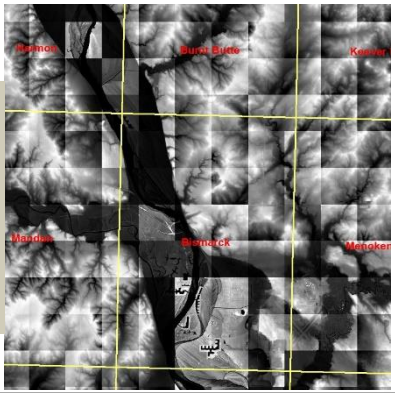
The highlighted areas are comparative 3D models created from 1,350 photos from our October 8, 2019 drone flight and 1,500 drone photos from our November 24, 2020 flight. Arrows point in the direction of slope movement. We estimated 420,000 tons of slide material.

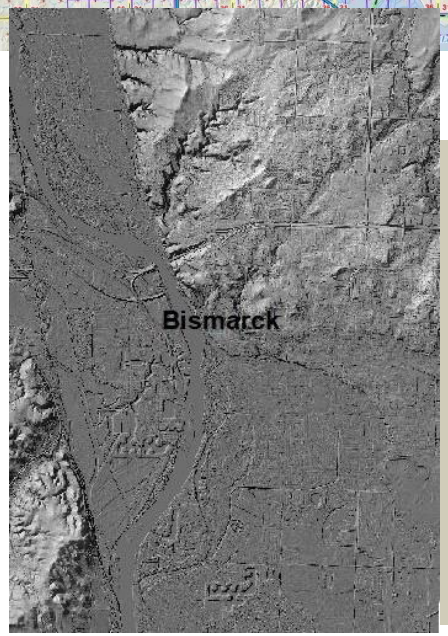
GEOLOGICAL SURVEY 24K and 100K LIDAR MAPS



LiDAR ASCII tiles on SWC Website. Tiles can be downloaded and brought into GIS software.

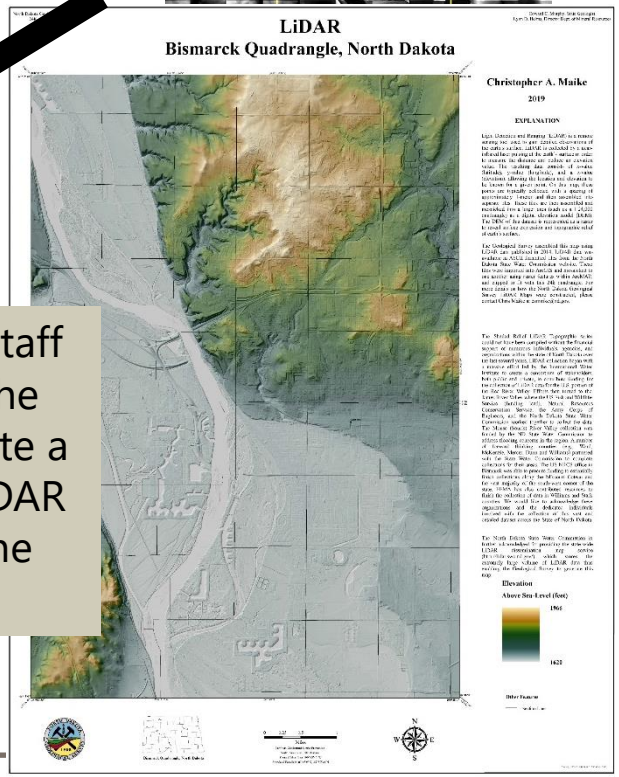
Appearance of tiles after brought into GIS Software.

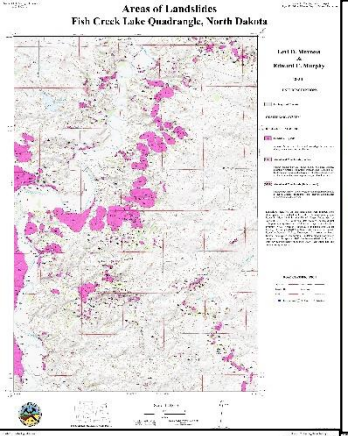


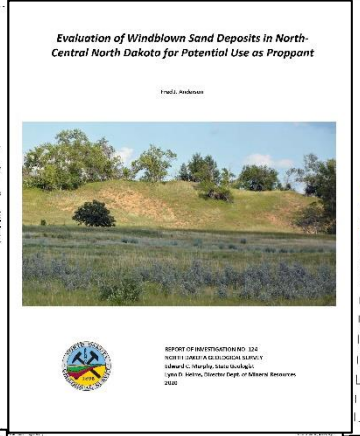


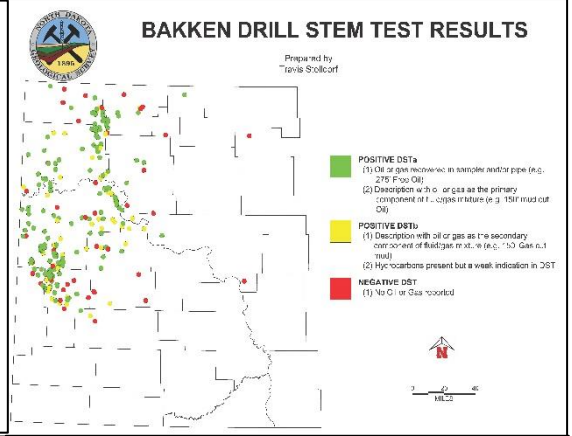
48 tiles for the Bismarck quad brought into GIS Software. Data was mosaicked and clipped. The DEM was then used to create a hillshade.

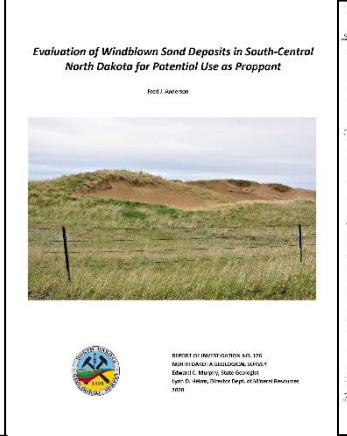
NDGS GIS staff then use the data to create a viewable LiDAR map for the public.

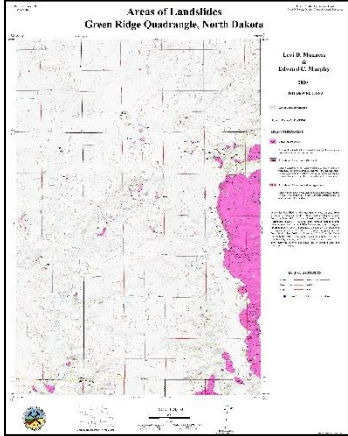


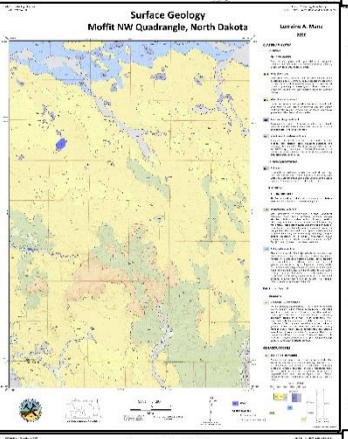


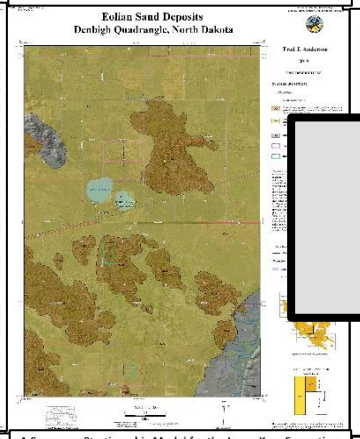


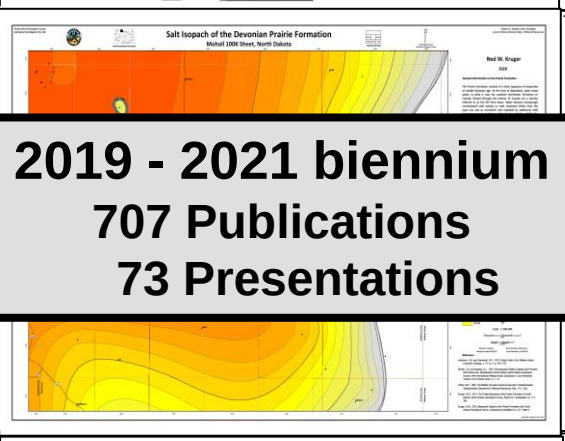


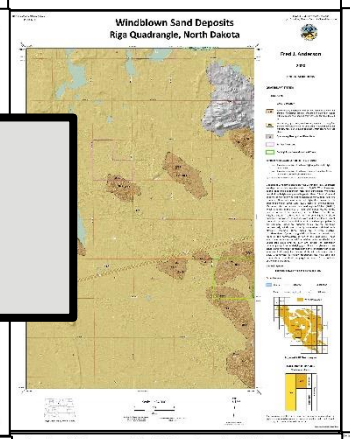


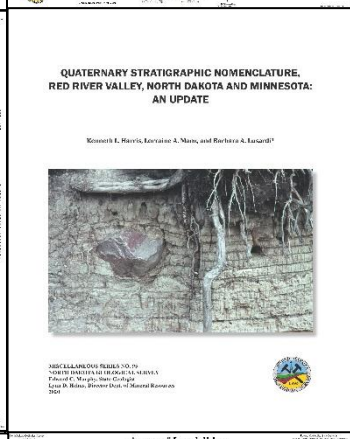




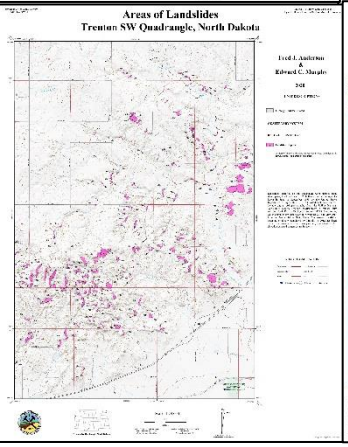


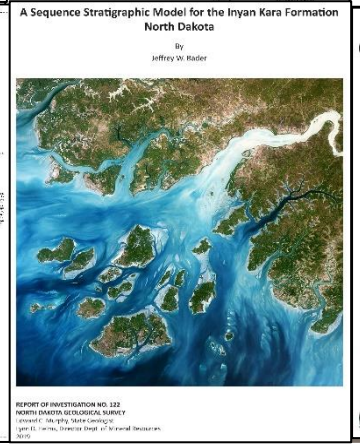


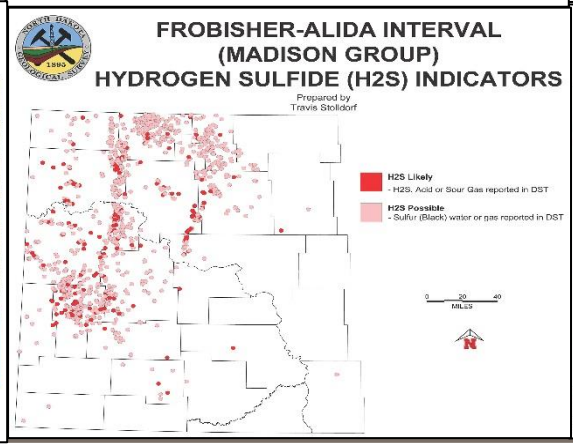


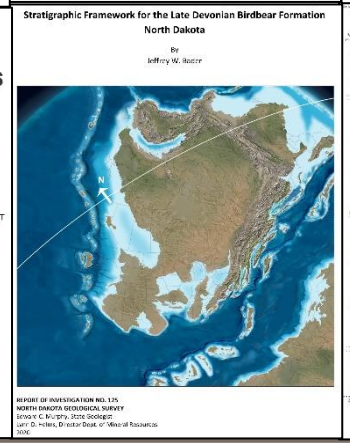


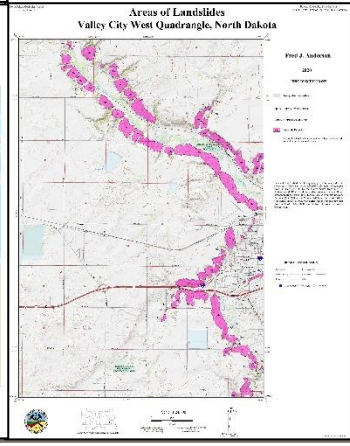
2019 - 2021 biennium
707 Publications
73 Presentations



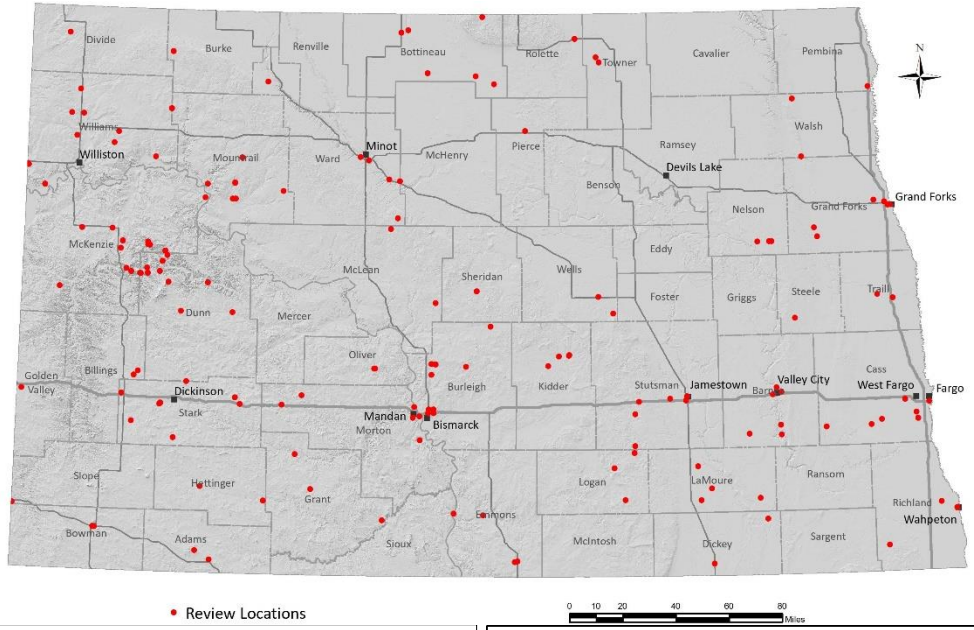


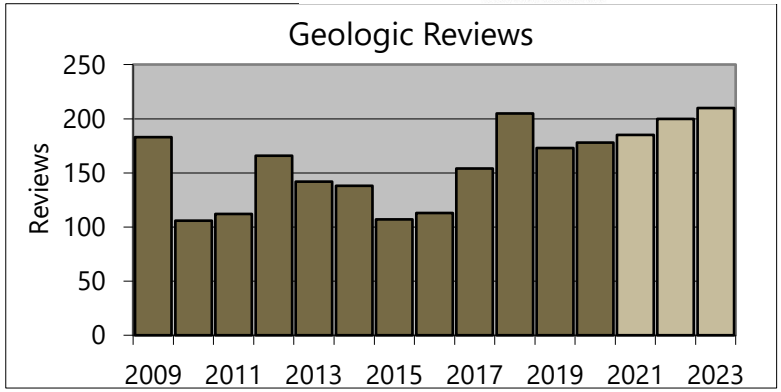


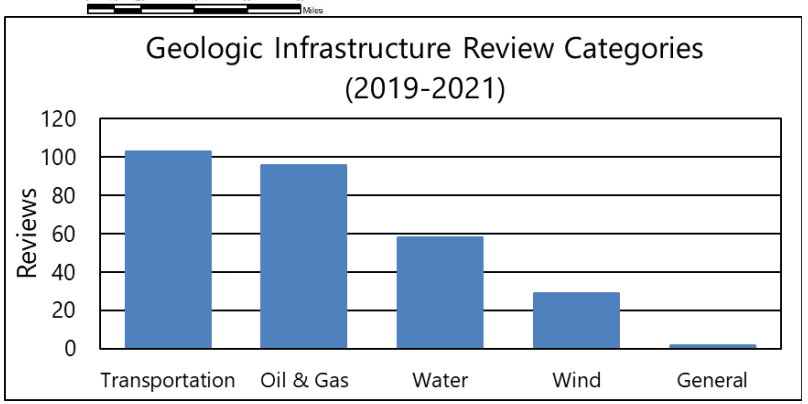




GEOLOGIC REVIEWS OF INFRASTRUCTURE PROJECTS







Top: The locations of the 288 infrastructure projects we have reviewed this biennium. Lower left: The Geological Survey reviewed 173 infrastructure projects in 2019 and 179 projects in 2020. Lower right: The majority of these reviews have been related to transportation and oil and gas.

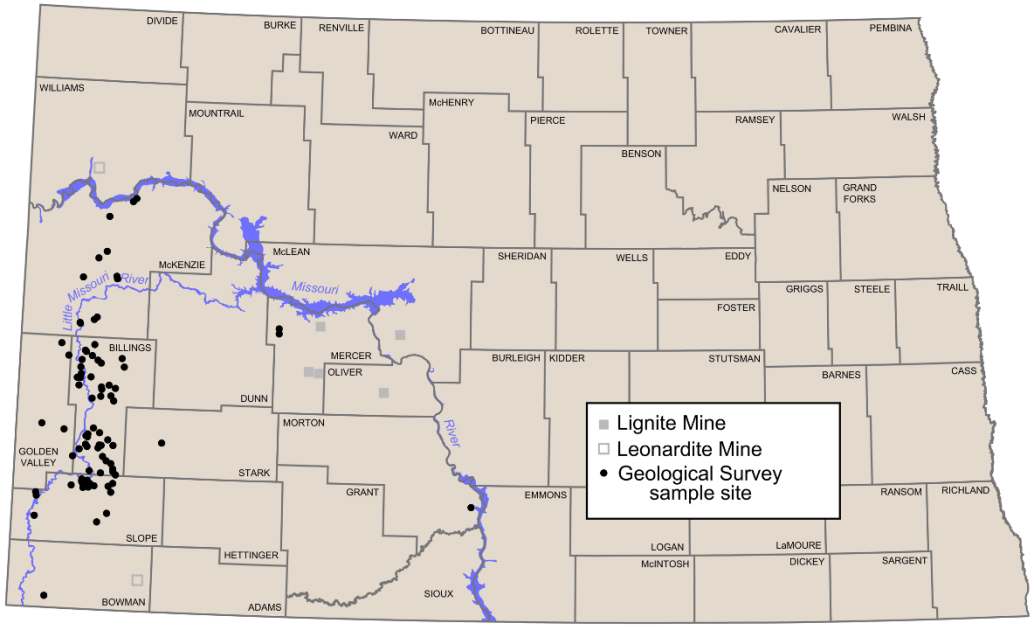
One-time Funding

SPECIAL PROJECTS

RARE EARTH SAMPLING PROJECT

(2019-2021)

We began studying rare earth element concentrations in North Dakota lignites in the fall of 2015, having received $107,000 in one-time funding to initiate the study. Under that first project, we collected and had analyzed 342 lignite samples from western North Dakota. Between 2017 and 2019, we used special funding supported the collection of an additional 855 samples and had 413 of those analyzed for their rare earth element contents. Twelve of our North Dakota lignite samples, coming from four different localities in western North Dakota, exceed 653 ppm, the highest concentration previously reported from a coal in North America. Our highest coal sample contains 1,598 ppm of rare earth elements, five times the economic threshold for coal set by the U.S. Department of Energy.



The locations of the Geological Survey lignite critical minerals sample sites.

2019-2021 One-Time Award

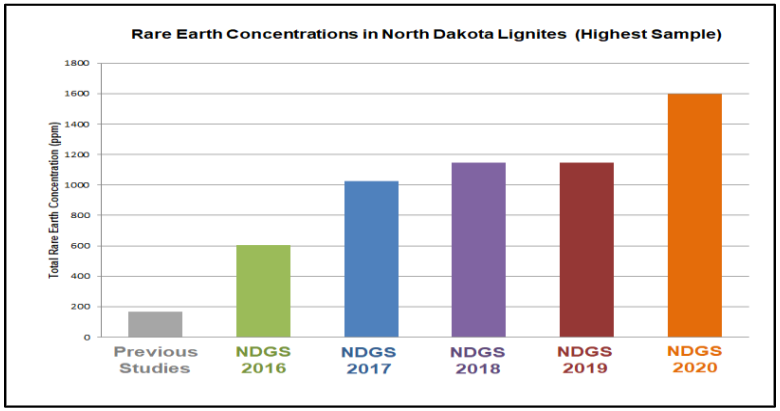
Sample collection (travel) =	$ 20,000
350 samples @ $400/sample =	$140,000
Total project award =	$160,000

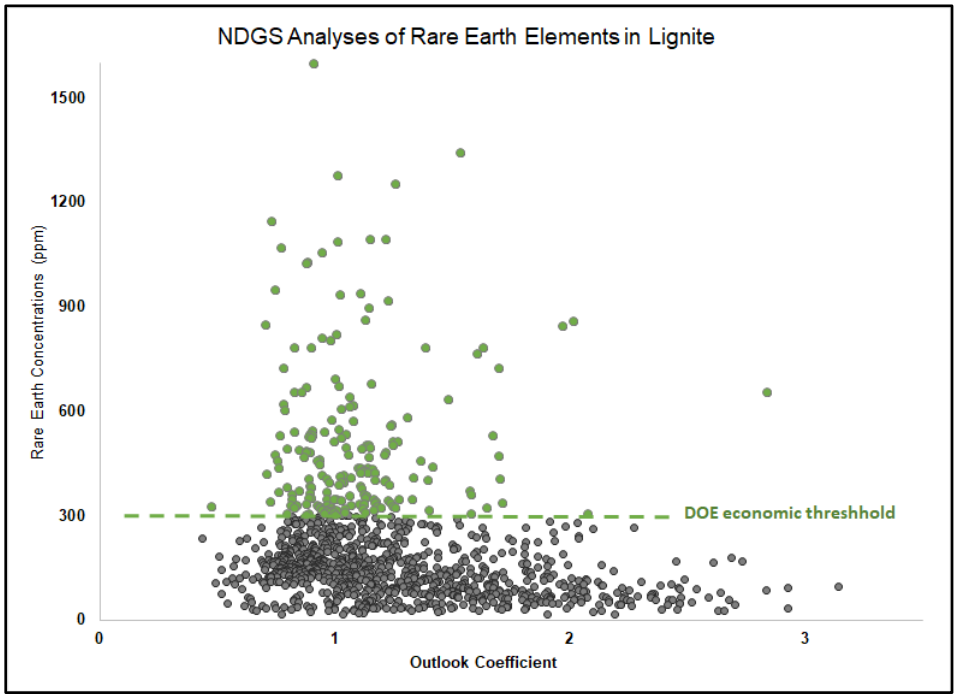
Project Spending to Date

258 samples collected (travel) =	$ 6,200
425 samples /critical analysis=	$ 75,068
423 samples/rare earth analysis=	$ 81,867
Total =	$163,135

RARE EARTH SAMPLING PROJECT

(2015-2021)





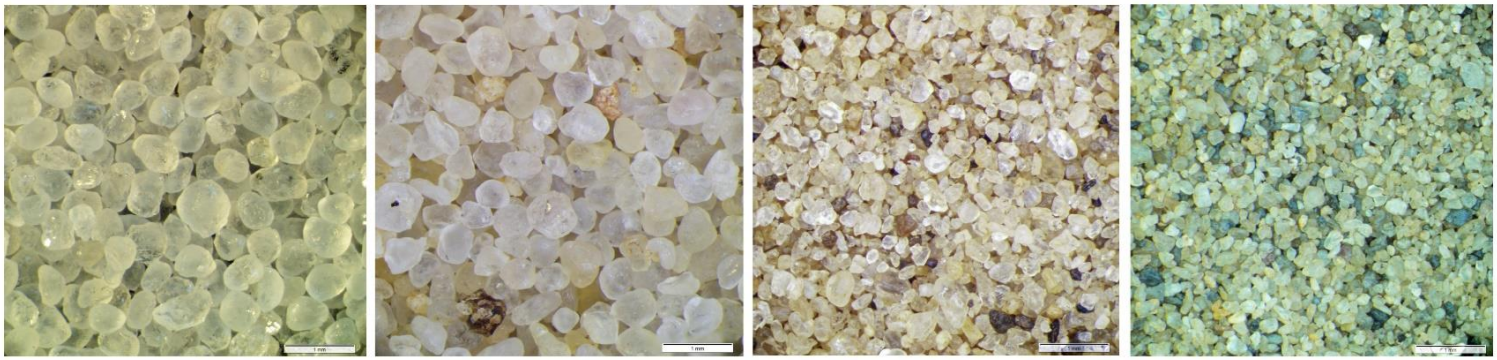
Upper Left: One of the Geological Survey 2020 study sites along the Little Missouri River in Slope County. Lower left: Prior to the Geological Survey study, the highest rare earth concentration reported from a North Dakota lignite was 165 parts per million, now it is 1,598 ppm. Right: The rare earth 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

During the 2019-2021 biennium, we received $110,000 in one-time funding to investigate the potential for North Dakota's windblown sand deposits to be used as proppant in oil and gas well completions. This was a continuation of a project we started in 2009 when we collected 83 sand samples across the state to evaluate their proppant potential.

19-21 Award	
Sample collection (travel) =	$ 10,000
40 samples @ $2,500 =	$100,000
Total project award =	$110,000

Samples Tested	Type of Analysis	Laboratory	Sand Resources	Cost
12	Proppant Sand Specifications	Lonquist Frac Sand Services, College Station, TX	South-Central North Dakota	$22,680
50	Bulk Sand XRD Mineralogy	Stim Lab, Duncan, OK	Statewide Windblown Deposits	$23,000
6	SEM Quartz Grain Images	Rocky Mountain Laboratories, Denver, Co	Hazen and Denbigh Deposits	$ 600
34	Proppant Sand Specifications	Lonquist Frac Sand Services, College Station, TX	Central ND and Denbigh Deposits	$63,300
102				$109,580
			Travel	$ 3,140
			Total	**$112,720**

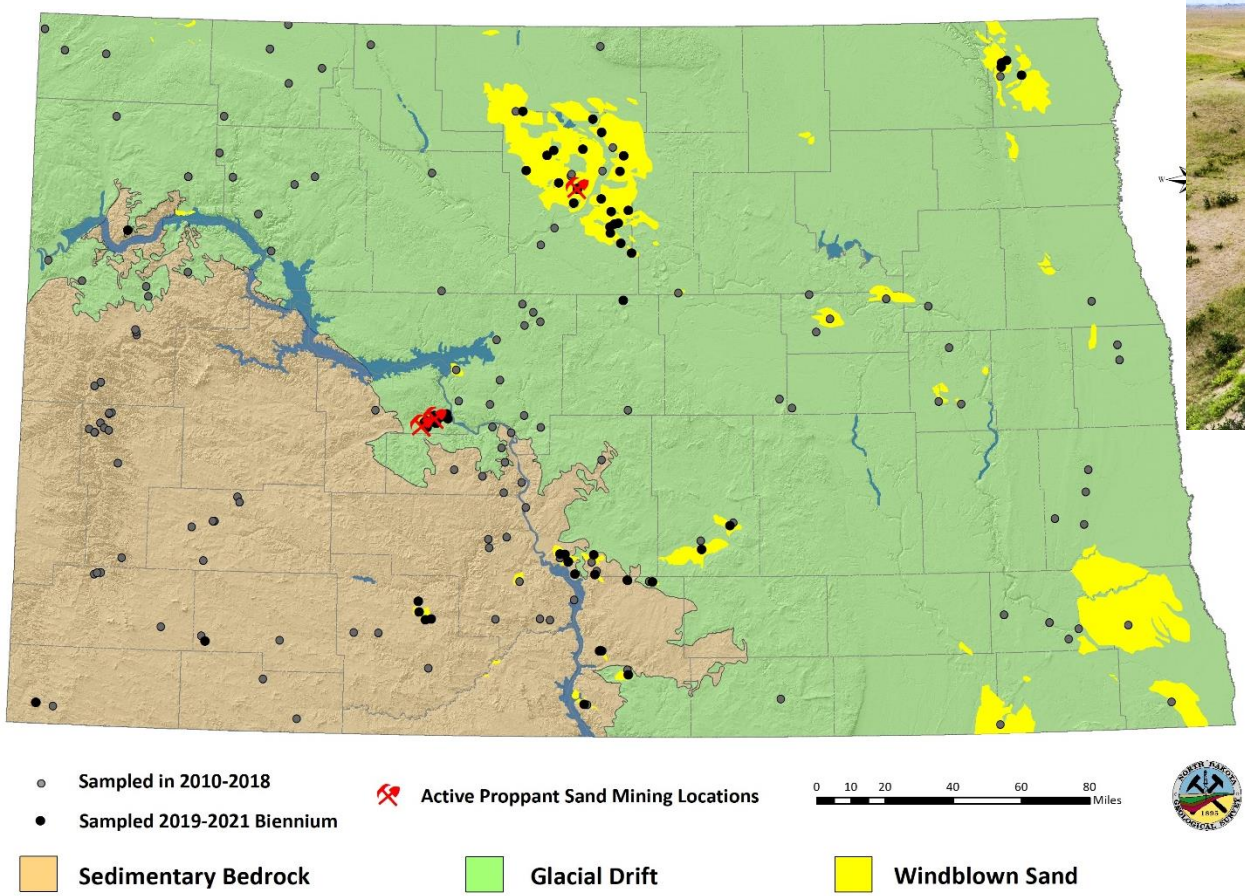


Ottawa White | Brady Brown | Denbigh Dunes | Hazen-Stanton Dunes

Photomicrographs of sand grains at 25x power. Traditionally, the vast majority of proppant used in well completions in the Williston Basin has been Ottawa White (Wisconsin and Minnesota). Brady Brown (Texas) has been used in the Permian play and other plays in the southern U.S. North Dakota windblown deposits contain smaller, more subrounded grains and have less quartz.

PROPPANT SAND PROJECT

(2019-2021)



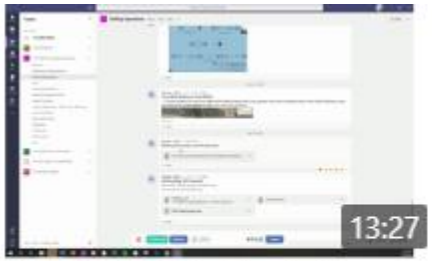
Left: A generalized surface geology map of North Dakota with sample locations plotted on it. Upper right: A blowout on the crest of a dune in the Hazen-Stanton dune field. Lower right: A Survey geologist collecting a windblown sand sample in the Denbigh dune field.

KNOWLEDGE RETENTION PROJECT

Years of Service	0-3	4-6	7-10	11-15	16-20	21-25	26-30	30+
FTE	28	20	20.5	15	7	5	2	6
%	19%	19%	20%	14%	7%	5%	2%	6%

DMR received additional temp salary funding to retain three employees in key positions with critical institutional knowledge who retired in 2019 to assist in built out of a DMR Knowledge Library.

Combined these employees have 118 years of experience in North Dakota oil fields.



Knowledge Retention in Team...
This is a quick video to walk through how to navigate this Knowledge Retention Database!

Oral History with Bob Garbe
Bob Garbe - DMR Minot Area District Field Supervisor - 1979-2019 Oral History Interview

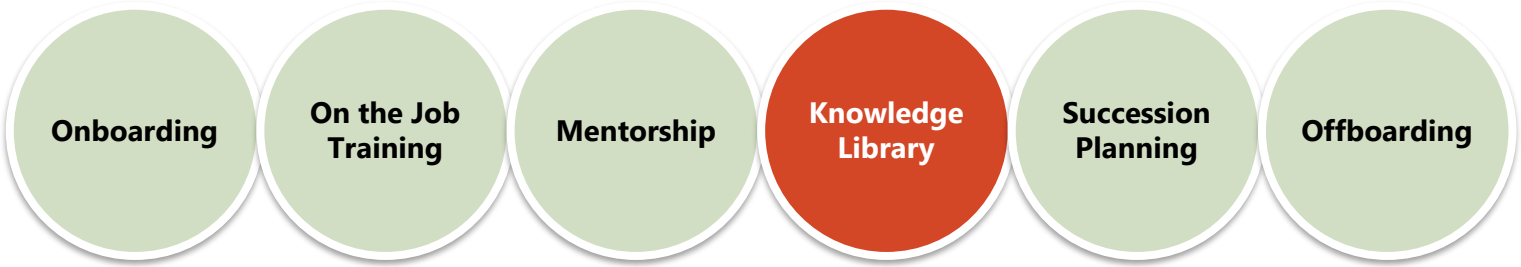
Oral History with Tom Delling
Tom Delling - Williston District Field Inspector 1981-2019 - 38 Years Oral History Interview

Oral History with John Axtman
John Axtman - DMR Williston District Field Supervisor - 1981-2019 Oral History Interview.

Links to View Oral History Videos and Knowledge Retention Overview:

- Bob Garbe: https://tinyurl.com/DMRBobGarbe
- Tom Delling: https://tinyurl.com/DMRTomDelling
- John Axtman: https://tinyurl.com/DMRJohnAxtman
- Knowledge Retention Overview: https://tinyurl.com/KnowledgeatDMR

KNOWLEDGE RETENTION PROJECT



Primary Needs:

Education and Research tool that is:

Specific to North Dakota field operations

Topic Based

Searchable

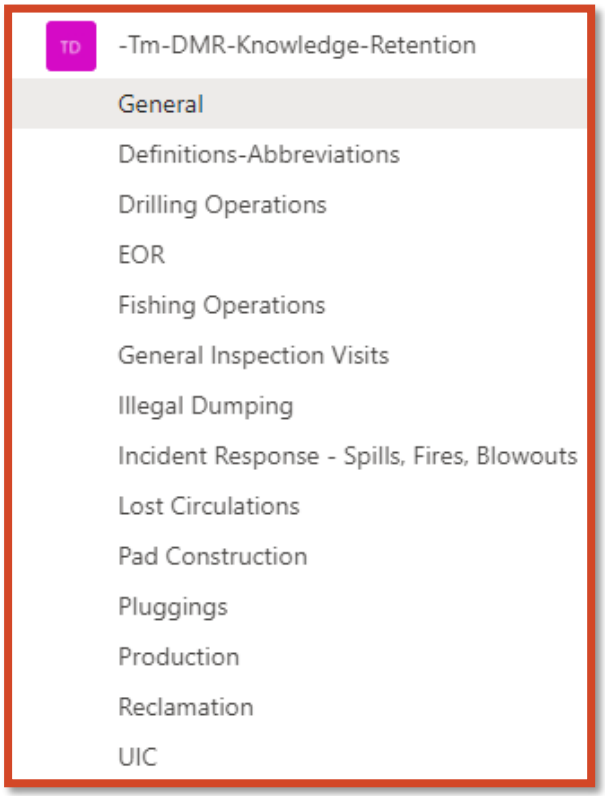
Mobile Friendly

Secondary Needs:

Generates Conversation

Connect Districts

Always Changing



Leveraging Microsoft Teams:

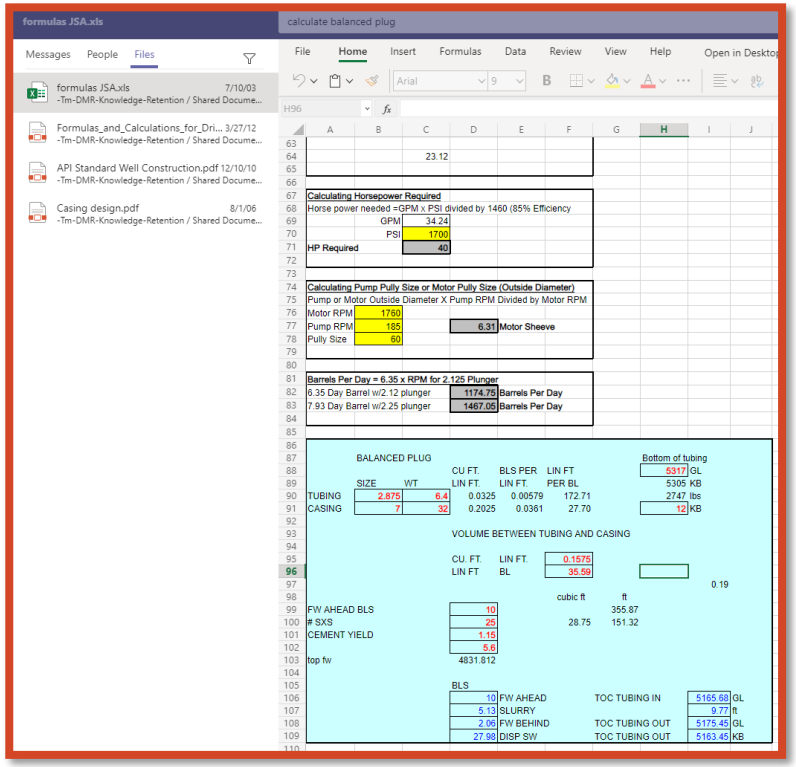
DMR staff chose Microsoft Teams as a solution for the Knowledge Library.

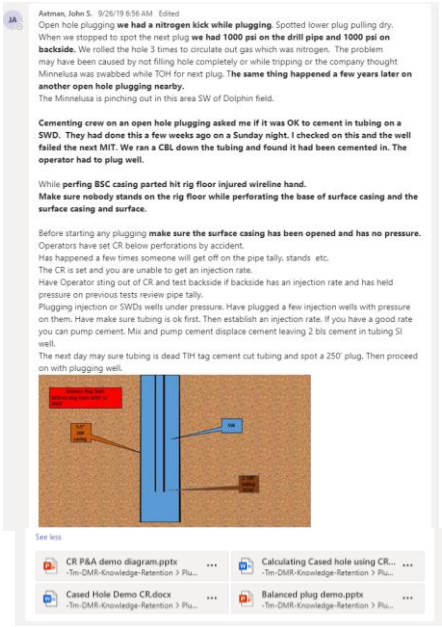
- Established 14 Categories for cataloging historical and current knowledge as well as future trends being seen in the field.
- All inspectors have mobile and desktop access.
- Over 130 files, 300+ images, and 250+ *conversations* generated by legacy employees and growing.

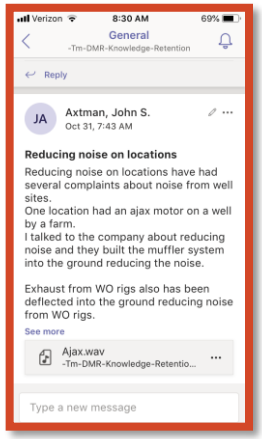
KNOWLEDGE RETENTION PROJECT

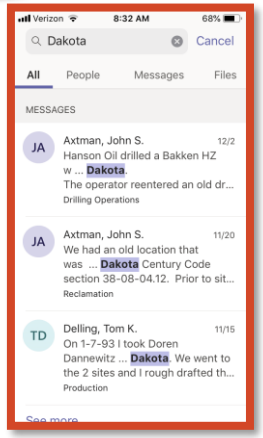
Onboarding | On the Job Training | Mentorship | **Knowledge Library** | Succession Planning | Offboarding

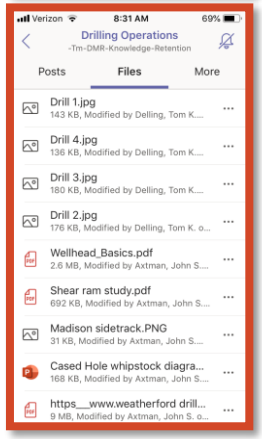
Quick. Simple. Interactive. Accessible.







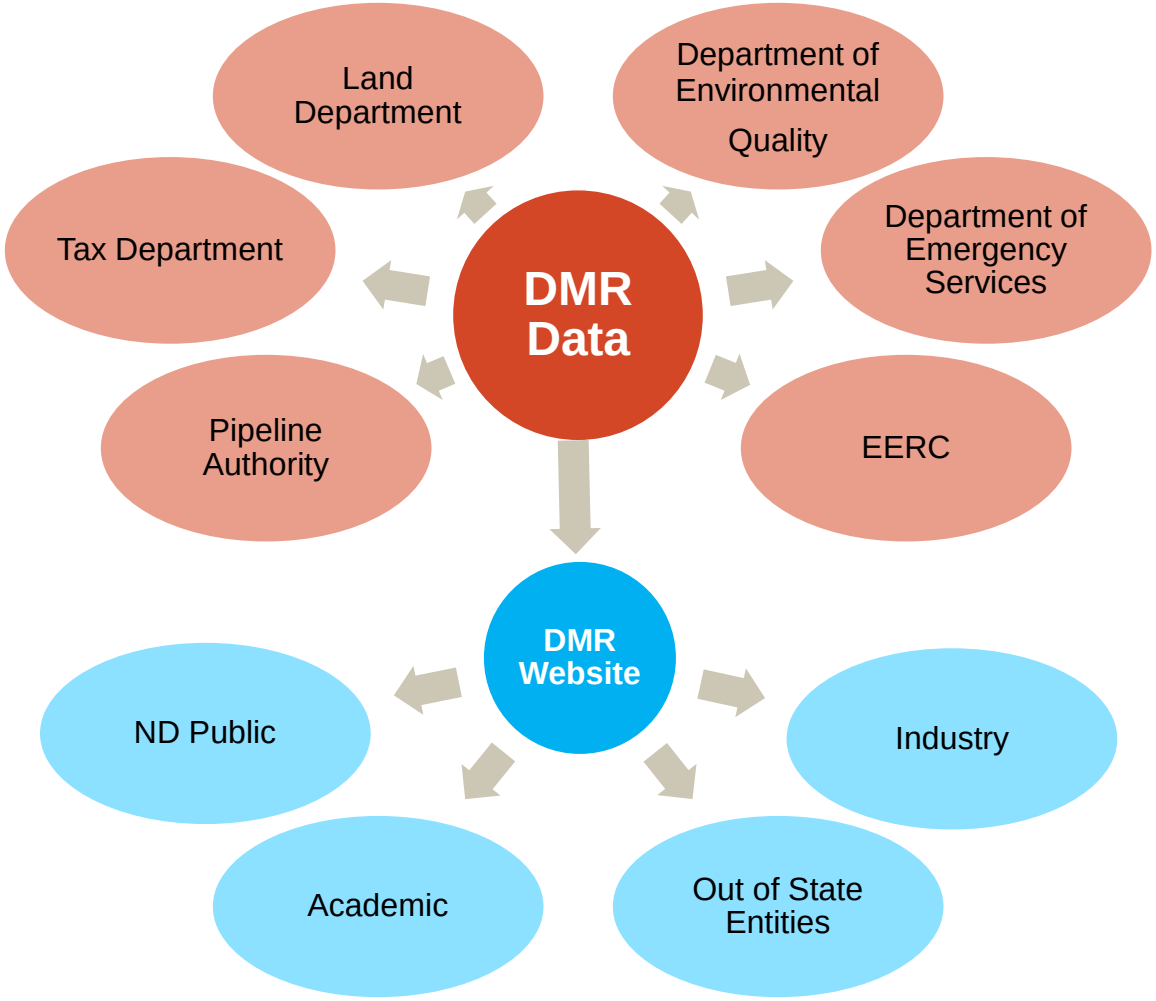




For viewing online: https://tinyurl.com/DMRKnowledge

RBDMS UPGRADE "NORTHSTAR" PROJECT

(DATA SHARING)



RBDMS UPGRADE "NORTHSTAR" PROJECT

(2018-2021)

North Dakota's Statewide Tracking and Reporting System "NorthSTAR" allows for cloud-based data storage and improved electronic regulatory filing options. A portion of costs are being shared by North Dakota Department of Mineral Resources and Ground Water Protection Council (GWPC).

Work is currently in the final release to build out the program. Release deliverables are outlined below and may be subject to minor changes. Originally four releases were planned, they were condensed into three to allow a period of knowledge transfer and maintenance and operations to be in the schedule.

Release 1 October 2018 - May 2019	Release 2 May 2019 – January 2020	Release 3 January 2020-June 2021	Additional Functionality Due to savings and DMR IT work
• Bond Management • Entity Management • Supplemental • General	• Well Management • Well Stimulation & Idle Well Data • Transfer of Ownership • Production • Underground Injection Control	• Inspections • Facilities • Hearing and Docket • Compliance • Incidents	• Geology module, Directional Survey component, Pipeline module, Field Inspection Master View, Data Tier Framework, .NET version upgrade

RBDMS UPGRADE "NORTHSTAR" PROJECT

COST DISTRIBUTION

Cost of NorthSTAR Project Build		
Project Build Activities *(Solution Provider + DMR Staff In-Kind)*	$	8,544,005
Additional Resources *	$	1,000,000
	$	**9,544,005**
Cost Distribution		
GWPC $ Contribution	$	1,996,030
DMR $ Contribution *(Drawn from Fund #317 Reservoir Data Fund)*	$	650,000
DMR Staff In-Kind Value	$	1,897,975
State $ Contribution AWPSRF	$	5,000,000
	$	**9,544,005**
*** Approximate Breakout of Additional Resources**		
ITD Cloud	$	150,000
ITD Project Management	$	250,000
ITD Large Project Fee	$	32,500
Attorney General Office	$	4,000
Software, Licensing, SP Travel	$	53,500
Management Reserve**	$	510,000

*Additional resources are items outside of Project Build Activities (professional services and development costs) of the NorthSTAR platform.

**Management reserve is for change requests that may be necessary during the life of the project.

CARES ACT FUNDING PROJECTS

	Amount Awarded	*Work to Date*	*Remaining Action*
Plugging Plugging of Abandoned wells in North Dakota confiscated by the NDIC.	$33,175,000 375 wells	$33,175,000 183,355 man-hours 1,380 FT jobs 281 wells	$0 54 wells to plug
Reclamation Reclamation of abandoned sites confiscated.	$16,300,000 185 sites	$16,300,000 52,861 man-hours 1,925 FT jobs 183 sites	$0 128 sites to be reclaimed
DUC Well Completions Reimbursement of funds for water acquisition, handling, and disposal for completion of DUC wells.	$16,000,000	$3,288,259 19 ND companies 400 FT jobs 15 wells	$12,711,741 65 wells waiting on invoices
Operating Covid-19 costs: hand sanitizer, non-contact thermometers, webinar upgrade, etc.	$1,512	$1,512	$0
	$65,476,512	**$35,843,533**	**$31,447,759**

Note: ITD provided teleworking resources which will be included in the ITD budget presentation.

PROGRAM COSTS & FUNDING

2019-2023 POTENTIAL CHANGES IN FEDERAL FUNDING

Federal Funding Program	2019-2021 Anticipated Award	2019-2021 Anticipated Change	2021-2023 Anticipated Award
UIC Oil & Gas (EPA)	$210,000	$77,249	$210,000
PSC Coal (OSM-DOI)	$15,000	$0	$15,000
Statemap (USGS-DOI)	$13,000	($13,000)	$13,000
Resources of Nat'l Park System	$0	$6,400	$0
USDA Forest Service	$0	$6,600	$0

MAJOR COMPONENTS - PROGRAM COSTS

The Department of Mineral Resources (DMR) budget is 99% general funds and <1% federal funds. Budget costs are primarily salary and benefits (80%). Federal funds for protection of fresh water supplies are not increasing, although program costs continue to rise due to inflation and federal environmental mandates. However, the agency continues to have statutory responsibilities to protect fresh water supplies. The federal funds are not expected to change over the current biennium.

The operating budget consists of travel (47%), primarily state fleet vehicle mileage for field work. Other operating items of significant costs include Lease/Rent/Facilities costs (24%) for the Bismarck office, warehouse, and three field offices; and IT costs (15%) more than half of which are ITD data processing, Telephone, and Contractual Services.

OTHER BILLS WITH BUDGETARY IMPACT

Operating Fees/Services

Litigation:

The 66th Legislative Assembly established a litigation pool in OMB's budget in the amount of $3,500,000. The Industrial Commission was provided access to the pool for the purpose of defraying expenses associated with possible litigation and other administrative proceedings such as:

- SB 2134 – 2017 65th Assembly – 1 case South Central District Court & 1 case appealed to SCOTUS
- SB 2334 – 2019 66th Assembly – 1 case Bottineau County Northeast District Court
- Bond Release – 1 case Burleigh County South Central District Court
- DAPL – US Court of Appeals District of Columbia Circuit
- BLM 11/18/16 Waste Prevention, Production Subject to Royalties, and Resource Conservation Final Rule - US Court of Appeals Tenth Circuit
- BLM 3/26/15 Hydraulic Fracturing on Federal and Indian Lands Final Rule - US Court of Appeals Tenth Circuit

The Attorney General budget (HB 1003) includes $3,000,000 from the Strategic Investment and Improvements Fund for a statewide litigation pool. The Industrial Commission currently estimates ongoing litigation costs at $2,000,000.

ONE-TIME FUNDING REQUEST
EQUIPMENT AND CAPITAL ASSETS INCLUDED IN SB 2014

Other Equipment <$5,000

Custom air chamber (Paleontology lab)	$2,500
WiFi (Paleontology lab)	$3,100
	$5,600

Other Equipment >$5,000

Drone & mobile station (Geological Survey)	$10,200
Trimble mobile receiver & software (Geo Survey)	$14,385
Microscope (Geological Survey)	$6,400
Scope & camera (Paleontology lab)	$21,565
Dust collector (Paleontology lab)	$10,650
Pallet rack shelving (Paleontology lab)	$5,122
	$68,322

IT Equip/Software over $5,000

Scanner/printer (Oil & Gas Division)	$10,000
Scanner/printer (Geological Survey)	$10,000
Wide-bed plotter (Geological Survey)	$7,338
Wide-bed plotter (Core Library)	$5,000
	$32,338

2021-2023 DMR BUDGET

	2021-23 Base Budget	SB 2014	Percent Change
40510 Salaries & Benefits	$21,911,356	$21,740,448	-0.7%
Salary Increases	$0	$600,255*	
40530 Operating Expense	$5,351,302	$4,637,891**	-13.3%
40550 Capital Assets	$0	$100,660	
40570 Contingent Positions	$229,544	$0	
Total Expenditures	$27,492,202	$27,079,254	-1.57%
Less Federal Income	$238,004	$238,004	
Total General Fund	$27,254,198	$26,841,250	-1.5%
FTE	105.5	101.5	-3.7%

Notes:
*Based on Senate Budget recommended increases to salary and health.
**Includes Senate funding for Microsoft Office 365 and equipment requests.

DMR BUDGET CHANGES

40510 Salaries & Benefits – Increased efficiencies were found in review of the DMR Staff Model and two office FTEs were cut. No reductions to field inspector positions after consideration due to the workload with the CARES Act appropriation. Out of the approximately 400 wells to be plugged and sites reclaimed, only 281 wells were plugged and 55 sites reclaimed by 12/30/20. The extension of the CARES Act funding and the need to plug approximately 94 wells and reclaim approximately 320 sites in calendar years 2021 and 2022 will extend the plugging and reclamation project into FY 2022. In addition, HB 1054 may generate additional abandoned wells. Idle well count is currently 3,331 versus 2,551 one year ago.

40530 Operating -The reduction in operating is primarily due to travel reductions. A large portion of the reductions are due to the decrease in the fleet rate from $0.47 to $0.23/mile. There are concerns that the rate will hold through the biennium having already seen increases in gas prices. Included in the operating line item are the funding for Microsoft Office 365 and the one-time equipment requests.

40550 Capital Assets – Included in SB 2014 are the one-time equipment requests of $100,680.

40575 Contingent Positions – The two contingent FTEs were cut. DMR does not anticipate significant growth in well count in the upcoming biennium.