APRIL 2015

FACTS ABOUT NORTH DAKOTA
FRACKING & WATER USE

With the growth of the oil boom in recent years, and the development of water dependent technologies that allow the capture of oil that was previously inaccessible, the public has expressed interest about how oil development may be affecting the availability of North Dakota's water resources.

This publication provides an overview of these issues and what they mean for North Dakota.

Developed by the North Dakota
State Water Commission

An oil drilling rig operates in western North Dakota.
Photo courtesy of ND Oil and Gas Division

ND OIL PRODUCTION TIMELINE

1951 Oil Discovered In North Dakota In Williams County near Tioga.

1984 North Dakota's First Major Oil "Boom" Peaks At 52 Million Barrels That Year.

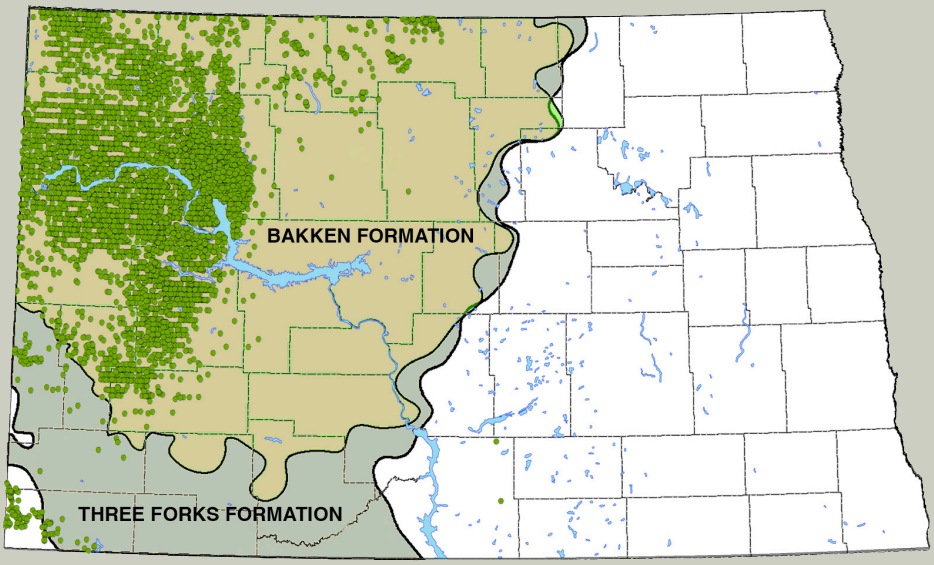
1987 North Dakota's First Horizontal Well Drilled.

2004 North Dakota's First Middle Bakken Horizontal Well Drilled.

ABOUT HYDRAULIC FRACTURING

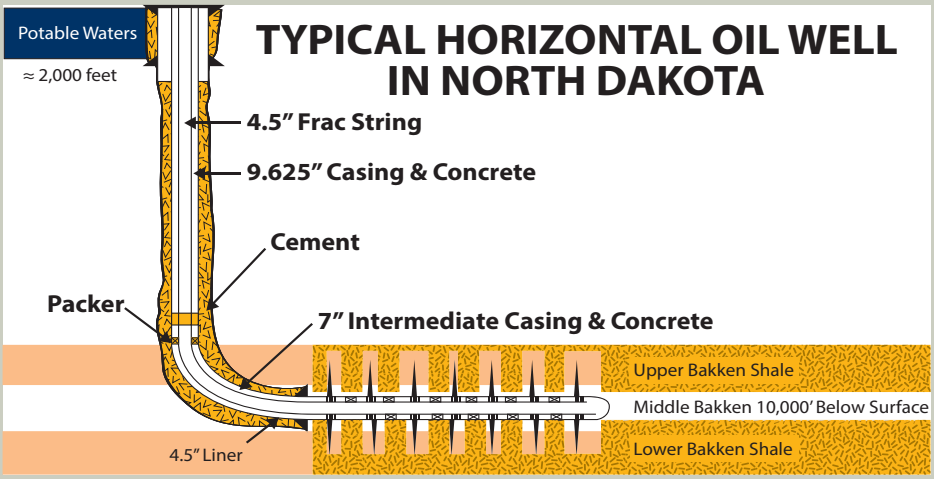
Hydraulic fracturing for oil or gas, commonly called "fracking", is a process where water and other materials are injected into oil-bearing formations of rock under high pressure, fracturing the rock, and releasing the oil. Oil wells of this type in North Dakota generally require approximately eleven acre-feet of fresh water for the drilling and hydraulic fracturing process, necessitating access to reliable water supplies. The effectiveness of fracking has allowed North Dakota to become the second largest oil-producing state in the United States, with a recent estimate of 7.4 billion barrels of recoverable oil reserves.

North Dakota has proven to have substantial deposits of oil-bearing rock suitable for fracking; currently in two rock formations - the Bakken and the Three Forks. Because the drilling process requires a fair amount of water to fracture the oil-bearing rock, both surface water and groundwater sources have been used. Where groundwater has been used, it has generally come from freshwater aquifers within two thousand feet of the surface, and that water is managed by the Appropriations Division of the Office of the State Engineer. Some water for fracking comes from saline aquifers located between five and six thousand feet below the surface. The water in these saline aquifers have picked up a great deal



Oil Wells

The location of the 11,770 oil wells in North Dakota drilled between 2007 and April 2015. Not all drilled wells end up producing oil.



Even though hydraulic fracturing processes in North Dakota happen thousands of feet below potable water sources, many safety measures are implemented to protect ground water from contamination.

2006 North Dakota Is The Nation's Ninth Largest Oil Producing State.

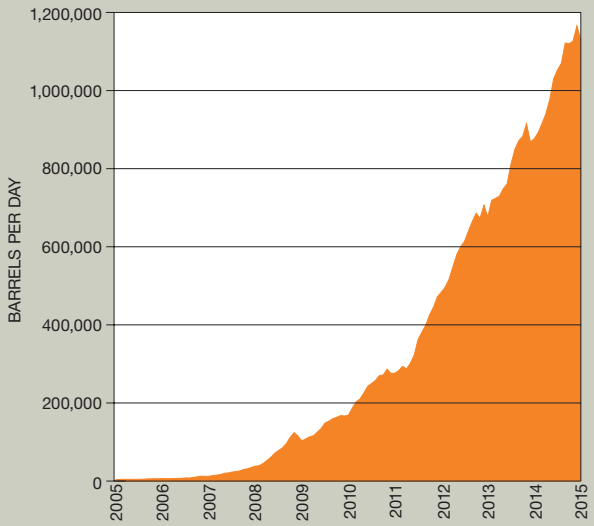
2007 Bakken Oil Production Begins To Increase Dramatically.

2012 North Dakota Becomes The Nation's Second Largest Oil Producing State (242 Million Barrels in 2012)- Behind Only Texas.

2013 A United States Geological Survey Estimates 7.4 Billion Barrels Of Recoverable Oil.

ABOUT HYDRAULIC FRACTURING

North Dakota Monthly Oil Production



Oil production in North Dakota increased exponentially from 2007, with the application of fracking technology. Source: ND Industrial Commission, Department of Mineral Resources, Oil & Gas Division.

of salts and other minerals from the surrounding rock, making the water in these aquifers in western North Dakota unsuitable for human consumption, but useful for some types of fracking. Surface water is the preferred source, because the region where the oil extraction is occurring contains the Missouri River, through which approximately 96 percent of the water in North Dakota's rivers and streams flows annually.

The Missouri River system is an extremely valuable source of water, both in terms of quality and quantity, although groundwater is used where it is difficult to get access to Missouri River water. (Missouri River access issues are discussed in greater detail on page 6.)

In other parts of the United States, fracking has been focused on shallow natural gas and oil bearing rock formations. Because these formations are so shallow, there has been concern about impacts from fracking to the shallow aquifers in those areas, which are often also used for drinking water. A study is currently being conducted by the Environmental Protection Agency in order to determine potential impacts from fracking. In North Dakota, the oil-bearing formations are much deeper, generally over 10,000 feet (nearly two miles) beneath the surface. This means oil wells are thousands of feet below potable groundwater aquifers.

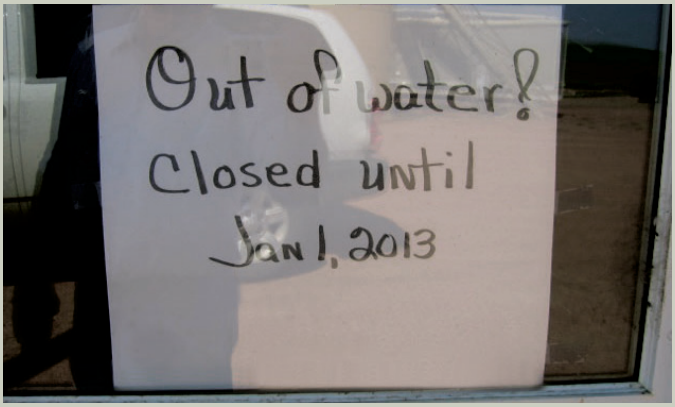
In between the potable aquifers and oil bearing rock formations, are approximately 8,000 feet (1.5 miles) of rock, separating the oil extraction process from drinking water supplies.

A hydraulic fracture stimulation is performed near Tioga, ND. Photo courtesy of ND Oil and Gas Division.

WATER MANAGEMENT & PERMITTING

North Dakota is a region prone to droughts and floods, so being able to accurately measure available water resources, such as their quantity, and how those resources change, has always been of vital importance. North Dakota's Office of the State Engineer is responsible for managing these resources, and has assembled an extensive and detailed water resources data program. The depth, breadth, and quality of that data collection is unprecedented in its scope today. Perhaps most importantly, the methodology used to collect and analyze this data is uniform, consistent, and scientifically defensible. Because of this extensive and constantly updated collection of data, the Office of the State Engineer is able to track impacts to the water resources of the state.

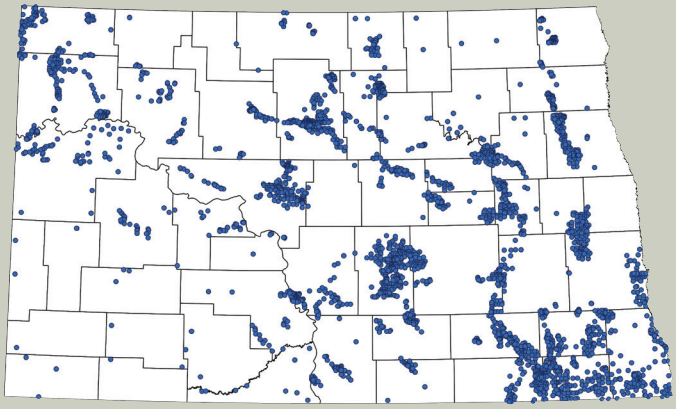
In addition to the tracking of ground and surface water resources, permitted water users are required to provide annual reports of their actual water use. Permitted water users are annually allocated a specific volume of water from a specific source, such as an aquifer or surface water source. Users are allowed to use up to the permitted amount, but no more. Metering and periodic monitoring are conducted for all industrial water uses. In the case of water use for fracking, a pilot process has been developed to provide even more frequent measurements of actual use, through on-site remote telemetry. The Office of the State Engineer is also moving forward with the addition of new staff to accommodate an increased workload related to water use for oil fracking.



A depot that had used their annual allotment of water indicates they are "Out of Water" for that year.

A meter tracks water use at a depot as part of the Office of the State Engineer's water use monitoring. Some depots are required to have additional monitoring equipment under the real-time (telemetry) pilot program.

When water use exceeds what has been permitted, the Office of the State Engineer has the authority to assess fines and penalties in order to discourage such actions in the future. Fines can be quite substantial, ranging from a few hundred dollars, to recent fines of $600,000 and $800,000. Further, if a user exceeds their allocated amount in a given year, the amount of overage is subtracted from their available amount the following year.



Observation Wells

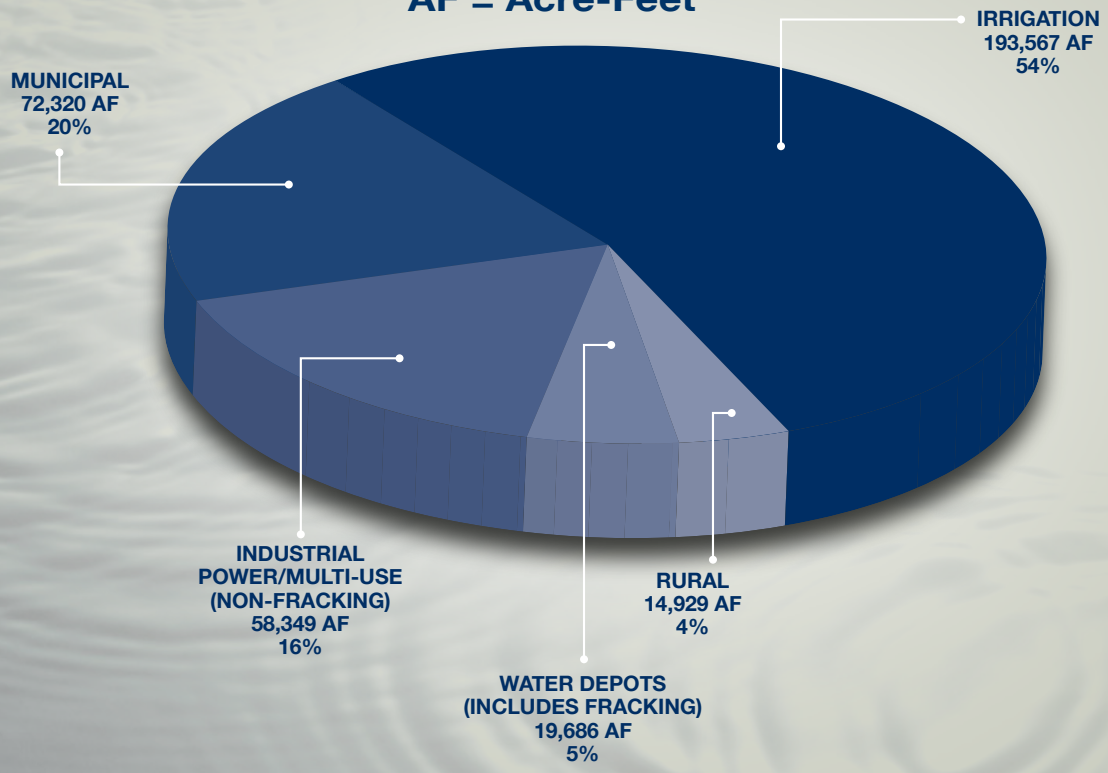
There are currently 4,190 observation wells maintained by the Office of the State Engineer in North Dakota, from which a wide variety of water data is collected.

Water trucks fill at a depot in western ND.

WATER USE FOR FRACKING

2013 Consumptive Water Use in North Dakota

AF = Acre-Feet



INTERESTING FACTS...

- The average fracking process in North Dakota requires about eleven acre-feet of water.
- In 2013, records indicate that 19,686 acre-feet of surface and ground water were used for fracking purposes. That amounts to 5% of North Dakota's 2013 consumptive water use.
- One day of the average daily flow of the Missouri River at Bismarck (45,480 acre-feet) is enough water to frack 4,135 wells, or 35% of all the wells that have been fracked in North Dakota.
- Evaporation from Lake Sakakawea is 2,472 acre-feet per day, or enough to frack over 350 wells.

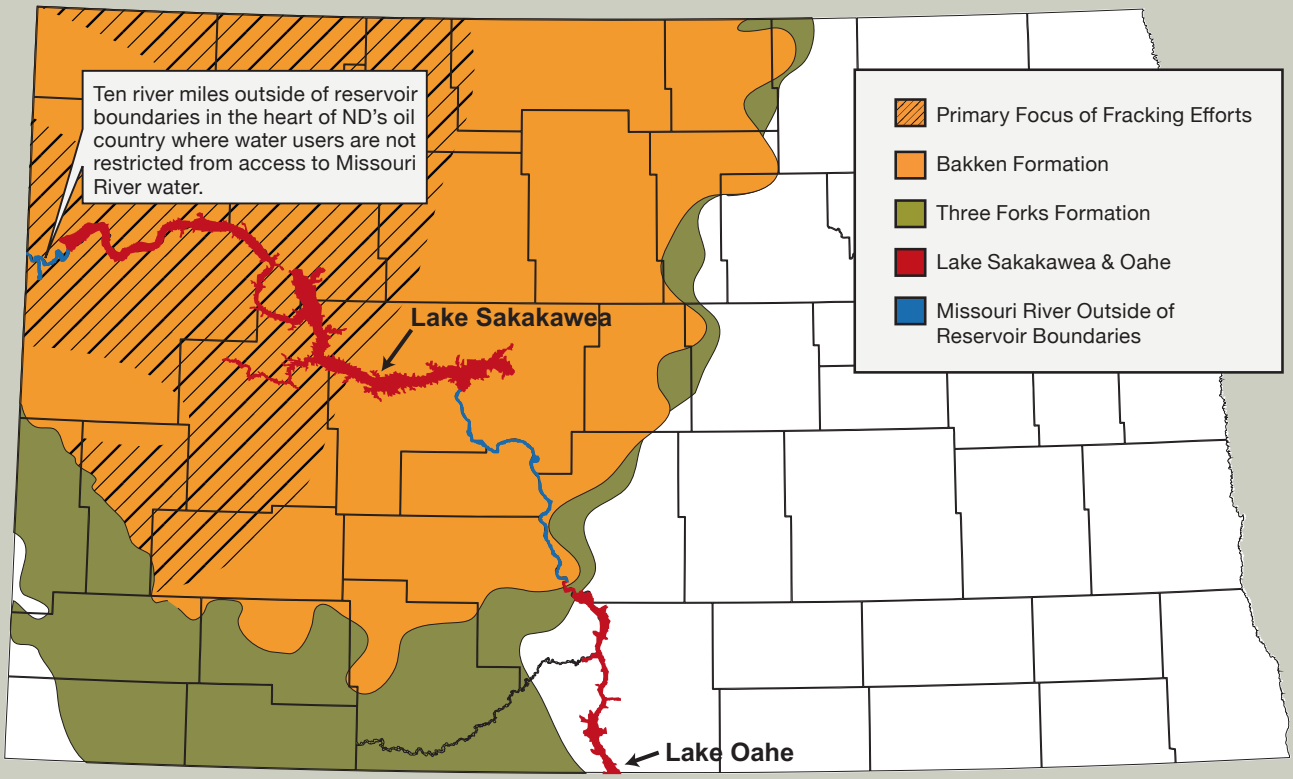
MISSOURI RIVER WATER ACCESS CHALLENGES

The Missouri River system is located in the heart of oil production efforts in North Dakota. However, though the Missouri River contains massive amounts of water that are readily available, water users in North Dakota have been denied access within reservoir boundaries by the U.S. Army Corps of Engineers (Corps) in recent years - pushing fracking operations toward alterative sources of water.

The Corps has been restricting access to Missouri River flows under their surplus water policy. This proposed policy is very complex, but in general, the Corps contends they have authority through the *Flood Control Act* of 1944 to charge fees for the use of "surplus" stored water in the mainstem reservoirs. The Corps defines surplus water as water that is available because of authorized project uses that were never fully developed.

The State of North Dakota has adamantly opposed this new Corps policy, maintaining that the flows of the Missouri River through the reservoirs are more than adequate to serve North Dakota's water users. The Missouri River continues to flow through Lake Sakakawea and Oahe, and those flows are not stored water. Furthermore, Article XI, Section 3 of North Dakota's Constitution provides that "all flowing streams and natural water source shall forever remain the property of the state..."

The Corps has restricted access to Missouri River flows within the boundaries of Lake Sakakawea and Oahe. That leaves only ten Missouri River miles accessible to industrial water users within the heart of North Dakota's oil country.



ADDITIONAL INFORMATION

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Scan to learn more about water appropriations in North Dakota