Development of a Historical Water-Quality Dataset for Samples Collected in the Williston Basin of North Dakota, Montana, and South Dakota

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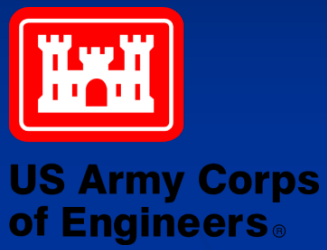
Bakken Federal Executives Group



Bakken Federal Executives Group (BFEG) Summary

1. **Scoping Phase**
   - Collaboration that identified and prioritized information needs in the Williston Basin
2. **Analysis and Synthesis Phase**
   - Synthesize existing information
   - Identify critical information gaps
   - Report delivery and data service – emphasis on access and utility for managers

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Bakken Environmental Status and Trends (BEST) Report Chapters

- Chapter A: Climate, physiography, land-use, demographics of the energy development area of the Williston Basin
- Chapter B: Water resources of the energy development area of the Williston Basin
- Chapter C: Biological resources of the energy development area of the Williston Basin

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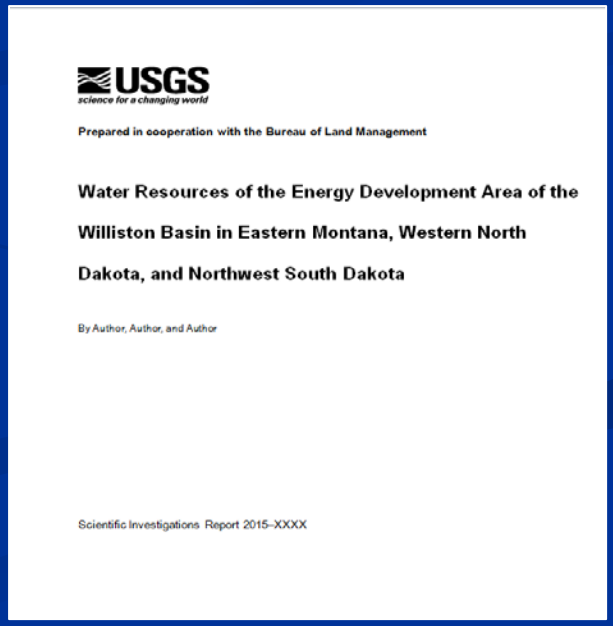
BEST Report Chapter B

- Introduction
- Groundwater Resources
- Rivers and Streams Resources
- Lakes and Wetlands Resources
- Quality of Water Resources
- Produced Waters
- Water Use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Prepared in cooperation with the Bureau of Land Management

Water Resources of the Energy Development Area of the Williston Basin in Eastern Montana, Western North Dakota, and Northwest South Dakota

By Author, Author, and Author

Scientific Investigations Report 2015–XXXX

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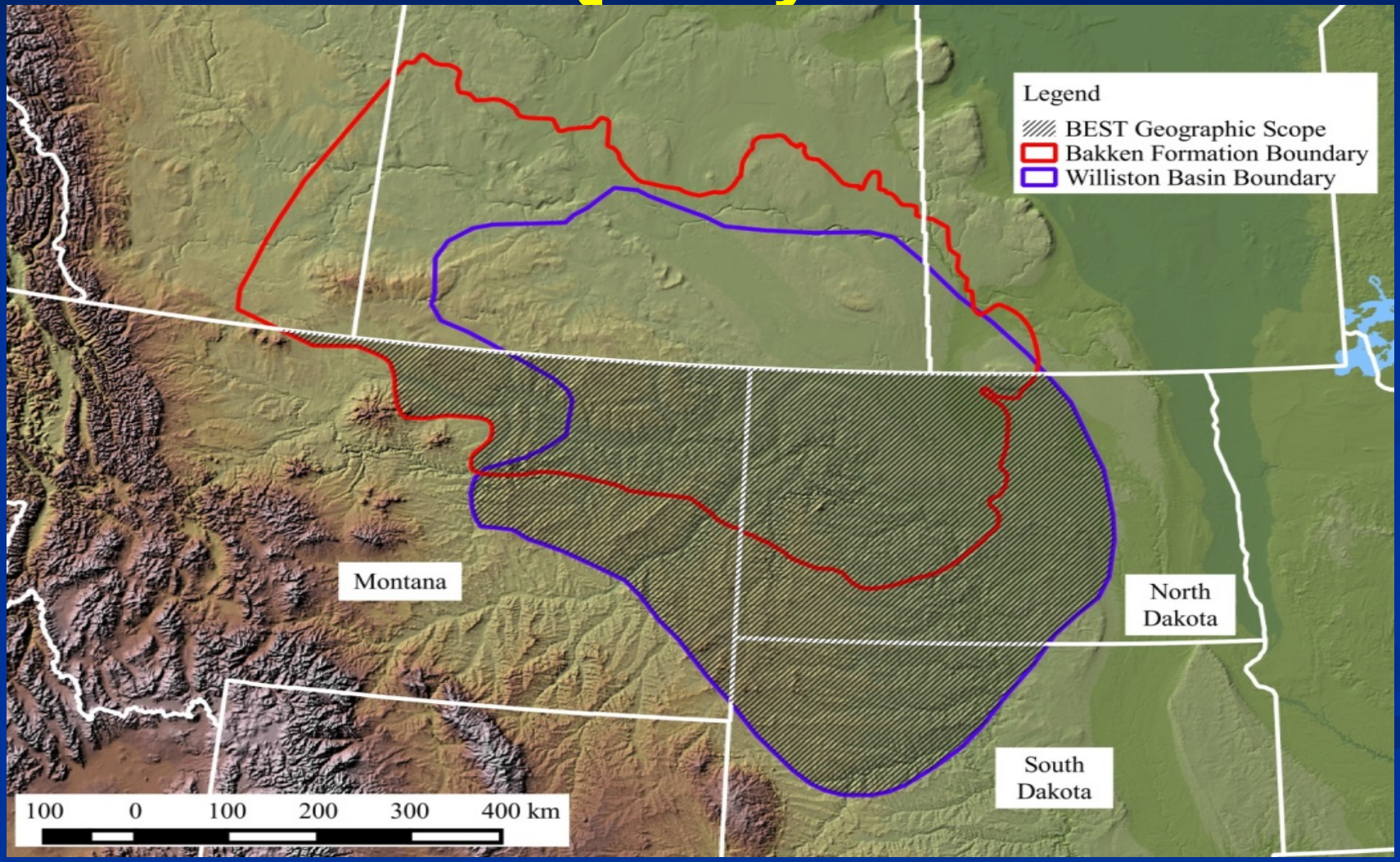
Development of a Historical Water-Quality Dataset



Water-Quality Sampling within the Williston Basin

- Water-Quality Samples collected by various Agencies
- Data Objectives Vary
  - Specific studies
  - Long-term sampling programs
- Samples collected for various reasons
  - compliance monitoring;
  - known pollutant releases (e.g. spills); or
  - characterization of conditions of a particular water resource

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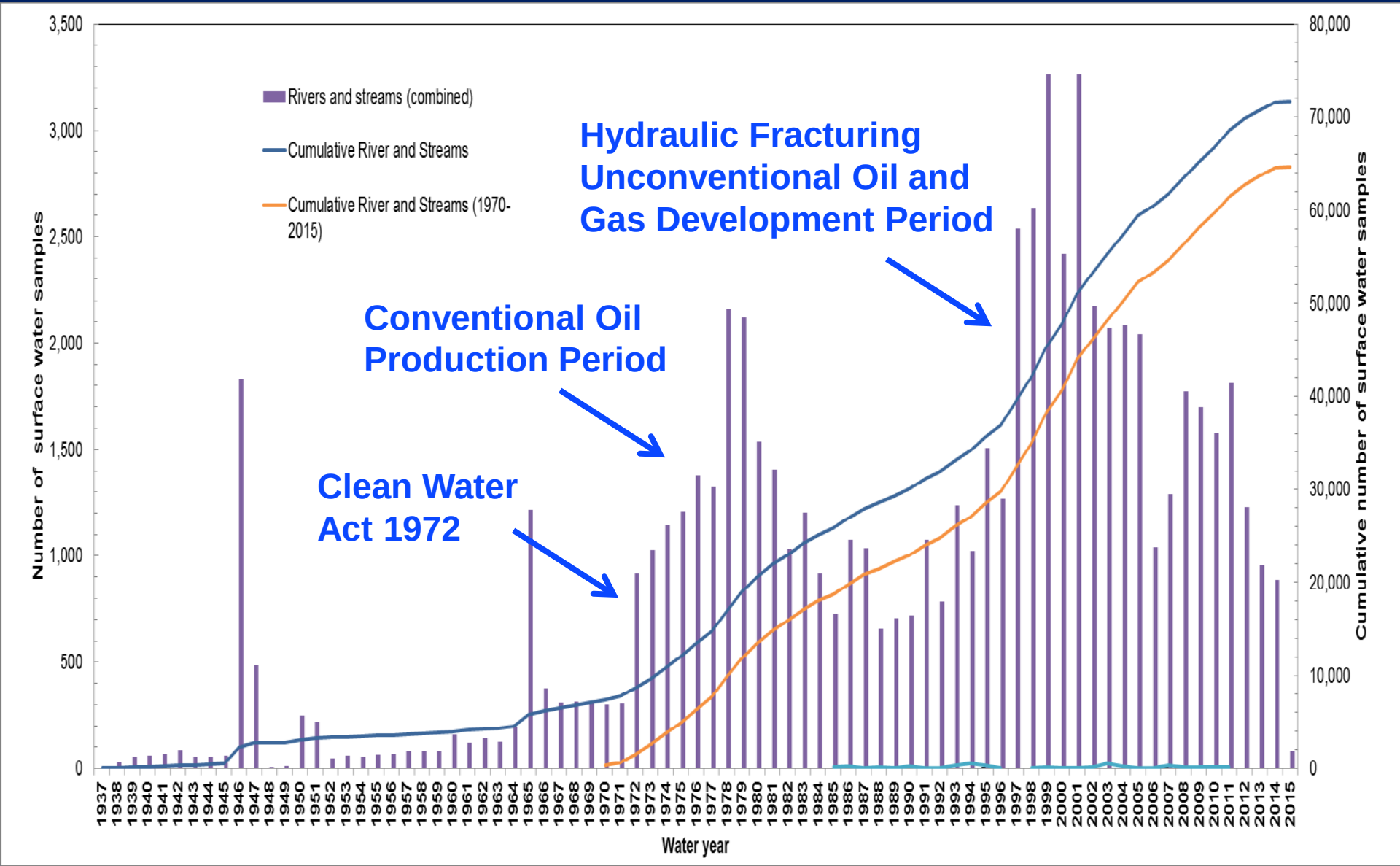
Data Retrieval Sources

- **Water-Quality Portal (WQP)**
  - Sponsored by USGS, USEPA and National Water Quality Monitoring Council
  - Integrates publicly available water-quality data
  - Retrieves water-quality data from Federal, State Tribal and local databases
- **USGS National Water Quality Assessment (NAWQA) Western States Data Aggregation**
  - Data compilation conducted during 2012-13
  - Data that was not required to be entered into USEPA STORET, or other nationally available databases

Water-Quality Data Period



Primary Constituents

- Five most commonly measured constituents
  - Specific conductance, Total dissolved solids, pH, Sulfate, and Chloride
  - Analysis period is 1970 through 2014
  - Lake Sakakawea period is 1993 and 2014
- Ten trace metals
  - Common in produced waters
  - Analysis period 1993 through 2014

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Dataset Challenges

- Select analyses deleted
  - Quality-control samples
  - Duplicate sites and samples
  - Identical data from multiple agencies
- Multiple constituent naming conventions
  - 5 different pH identifiers (pH dissolved; pH total mg/L; pH total std units; pH total units/cm)
  - "Total dissolved solids", "tds", or "solids, dissolved"

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Refinements of the Dataset

- Various reporting units
  - Specific conductance-only those reported as micro Siemens per centimeter at 25 degrees Celsius.
  - TDS-precedence placed on measured values
  - pH-precedence placed on field values
  - Trace Metals – all converted to μg/L units
- Censored level ("less-than")
  - Common censoring level for each constituent was beyond scope of project

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Matrices and Ancillary Information

- Groundwater
  - Lat/long and screened aquifer (depth component)
  - Selected wells with known location and aquifer
- Streams and Rivers
  - Another site within 100 m required investigation
  - Sites compared if located on same water body
- Lakes and Reservoirs
  - Similar process as streams and rivers
- Extensive QC review resulted in more refined dataset for future analysis

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Matrices Characterization

- Groundwater
  - 25 categories, only selected domestic, municipal, observation, industrial, production, stock well
- Streams and Rivers
  - Eight categories, selected those coded as river/stream and stream
  - Greater temporal variability, so needed to be sampled at least 10 times
- Lakes and Reservoirs
  - Six categories, selected those coded as lakes, reservoirs, and lake/reservoir/impoundments
  - Samples are often collected at different depths

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Developed Characterization Dataset

- **Groundwater**
  - **16,188 wells available, and after removing duplicates 7,502 wells evaluated for at least one of the 5 primary constituents**
- **Streams and Rivers**
  - **2,948 sites available, and after removing duplicates and those with fewer than 10 samples, 329 unique sites had at least one of the 5 primary constituents**
- **Lakes and Reservoirs**
  - **1,838 lakes available, and after removing duplicate sites, 839 lakes sites were evaluated**

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Implications

- Because of various study objectives, the availability of consistently collected, systematically processed and reported data over large portions of the Williston Basin is limited
- The dataset provides important historical data, and serves as a strong planning tool to design future water-quality monitoring programs

Considerations for a Coordinated Water-Quality Sampling Program

- The BFEG may want to consider coordinating with agencies and industry that have water-quality sampling efforts
- May result in an efficient sampling program, improved cooperative approaches, and design of a long-term and consistent strategy for sampling
- Data types collected in the future may be revised to provide missing information

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Considerations for a Coordinated Water-Quality Sampling Program, *cont.*

- Design an efficient Williston Basin water-quality sampling program that requires both spatial and temporal components to minimize redundancy
- Sampling locations for the three matrices need to be identified to provide consistent information for designing future water-quality research and mechanisms for comparisons against historical samples

Considerations for a Coordinated Water-Quality Sampling Program, *cont*.

- Additional constituents to consider as indicators of produced waters include boron, bromide, fluorine, iodine, lithium, manganese, radium, and strontium isotopes
- Install continuous water-quality monitors to potentially identify spills on a real-time basis

QUESTIONS

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