

South Dakota

*Department of Environment
& Natural Resources*

Minerals and Mining Program

Oil & Gas Section - Rapid City, SD

**SHALLOW GAS EXPLORATION & PRODUCTION
IN
SOUTH DAKOTA**

PAST, PRESENT, AND FUTURE

BY

GERALD (MACK) MCGILLIVRAY

2008 ROCKY MOUNTAIN UNCONVENTIONAL GAS CONFERENCE

OCTOBER 15-17, 2008

HISTORY OF SHALLOW GAS IN SD

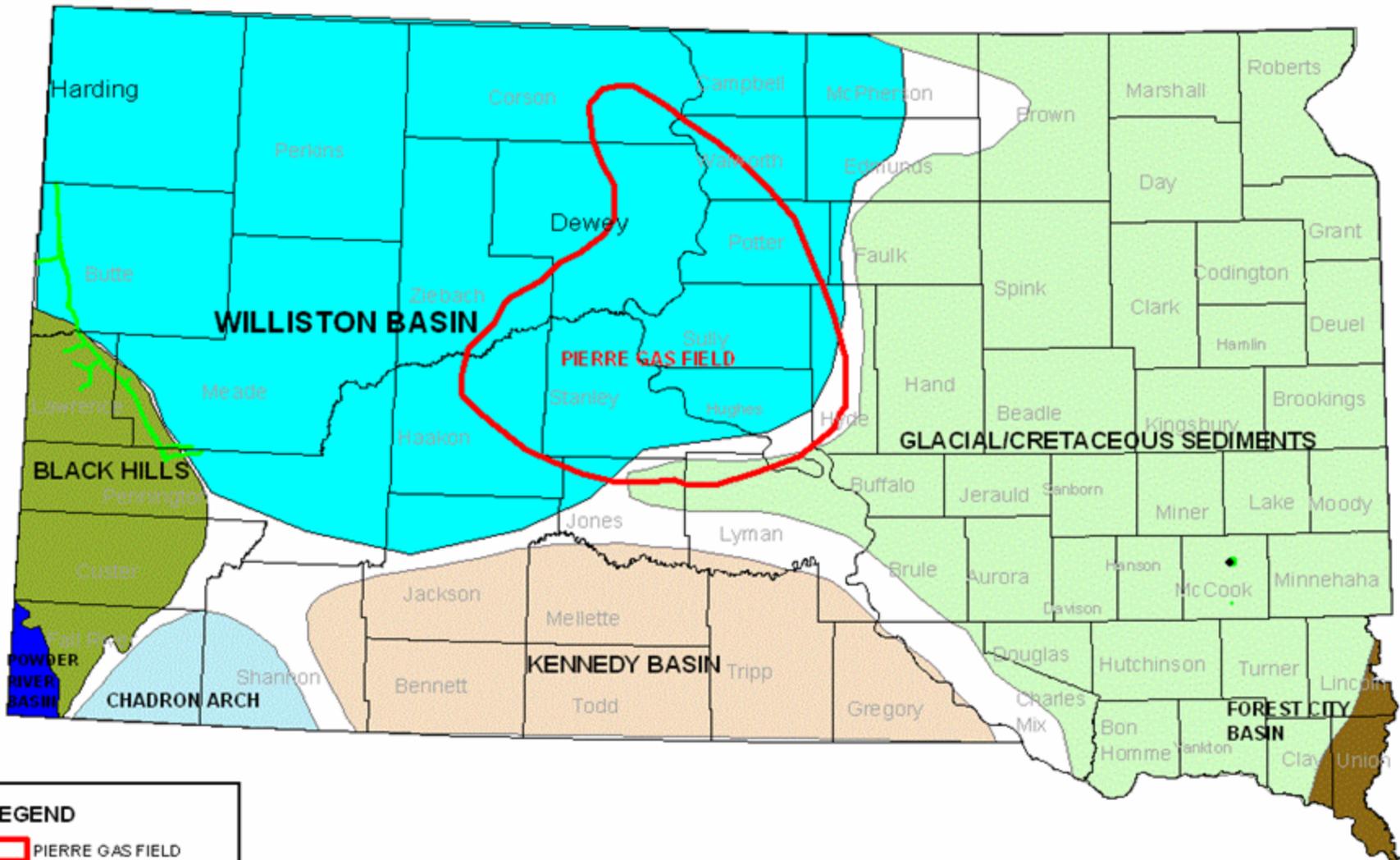
A Timeline

- Waaay back: Pierre Gas Field 1889-1948
- Oil & Casing Head Gas (Too Deep & Low BTU): 1954-Present
- Not so far back: Harding Co. Eagle/Shannon
WSPH & Cady Creek Fields: 1977-Present
- Recent Past (Last Five Years) and Present: Pierre Gas Field Revisited,
Sub-Glacial Gas, and New Field in Harding Co.
- Future???

PIERRE GAS FIELD

1899-1948

CURRENT AND POTENTIAL OIL & GAS PRODUCING BASINS/AREAS IN SOUTH DAKOTA

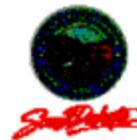


LEGEND

- PIERRE GAS FIELD
- FOREST CITY BASIN
- CHADRON ARCH
- KENNEDY BASIN
- GLACIAL/CRETACEOUS
- BLACK HILLS
- POWDER RIVER BASIN
- WILLISTON BASIN



0 5 10 20 30 40 Miles
Scale 1:2,500,000



South Dakota
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BY FRED STEECE AND MACK MCGILLIVRAY

PIERRE GAS FIELD HISTORY

- 1889 Pierre Gas Plant installed
- 1892 Gas from Indian School water well *flared* until 1939
- 1894
 - Locke Hotel; cook, heat, lights
 - City Gas Plant; “(every) home...”
 - City Streets; all lit with gas

GAS ANALYSES

■ State Capitol Well

- CH₄.....94 %
- N₂..... 5.7
- O₂..... 0.13
- CO₂.....0.06
- Btu.....907

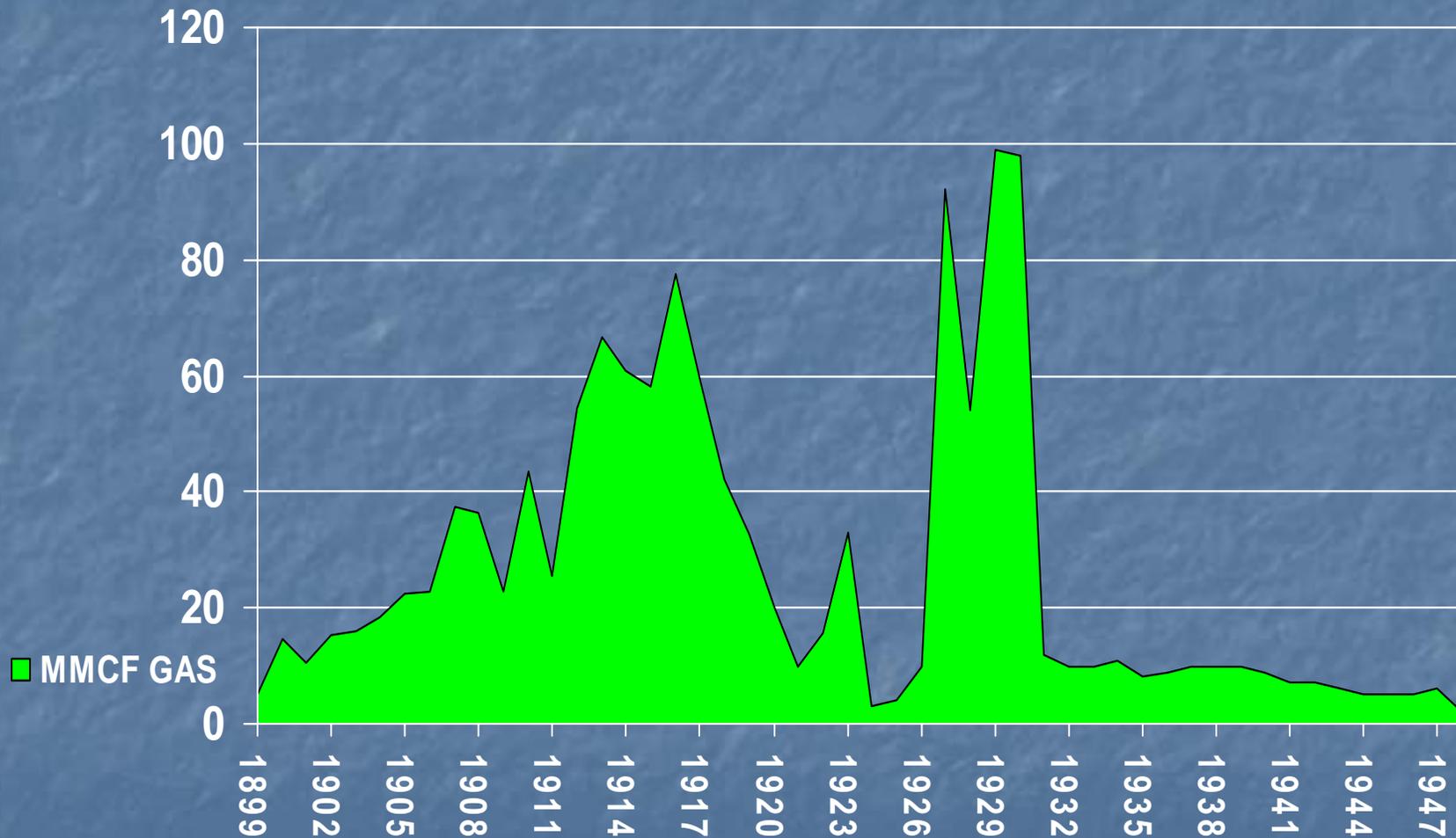
Analysis by S.D. State
College

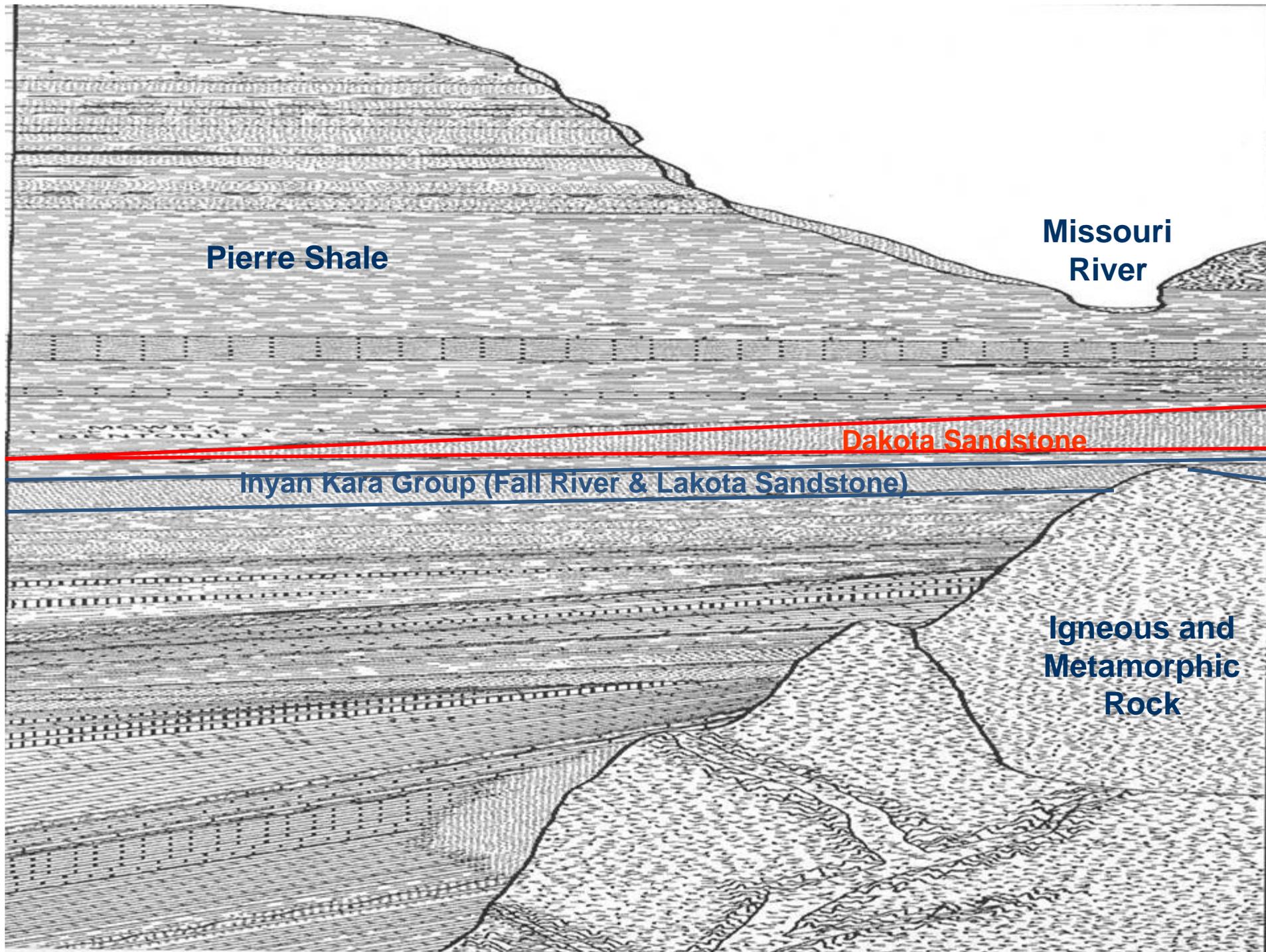
■ Pierre City Wells

- Methane.....78.8%
- Ethane.....13.2
- Propane.....10.7
- Butane.....1.3

Analysis by Carter Oil
Company

Pierre Area Natural Gas Production 1899 - 1948





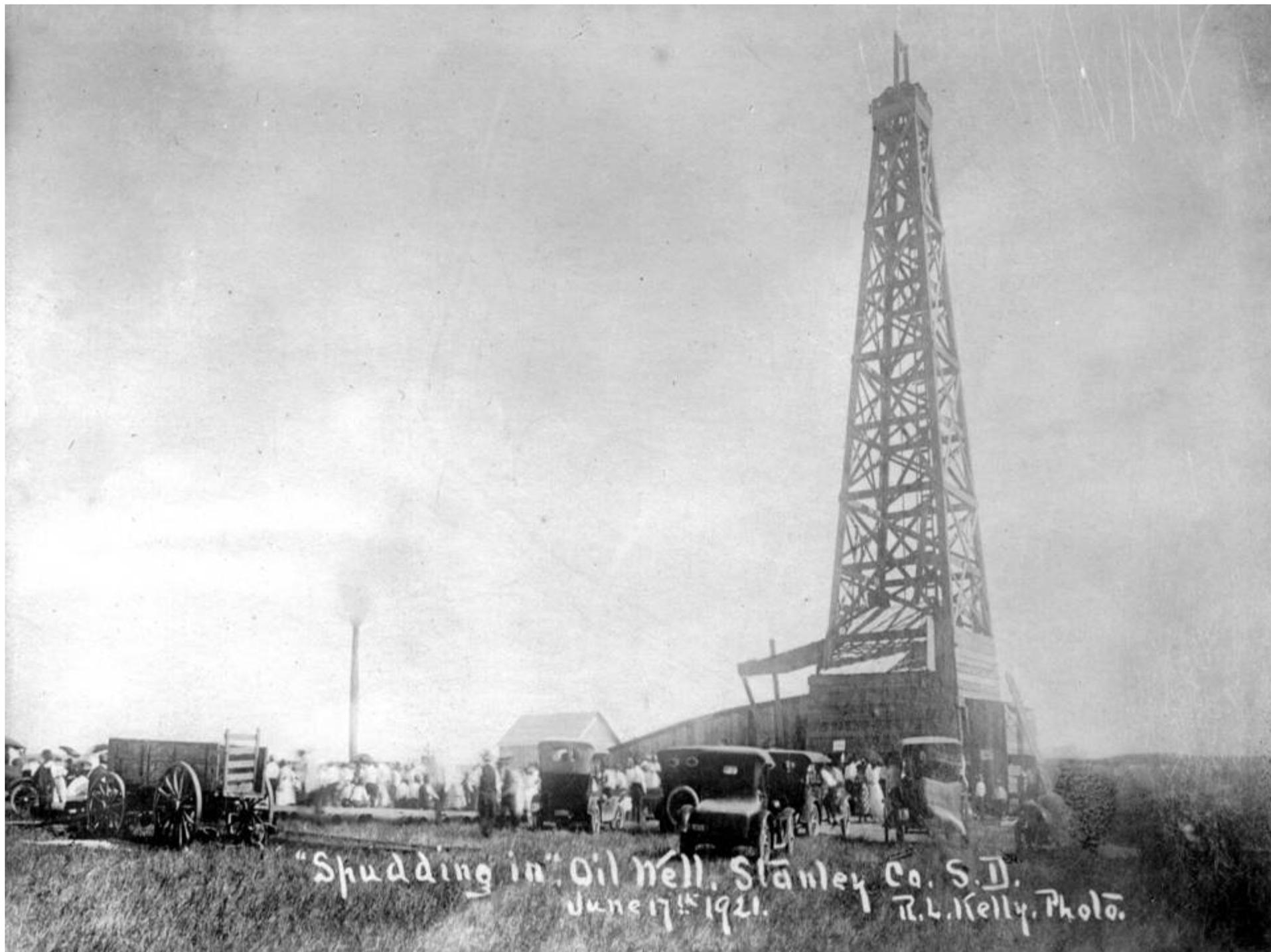
Pierre Shale

Missouri River

Dakota Sandstone

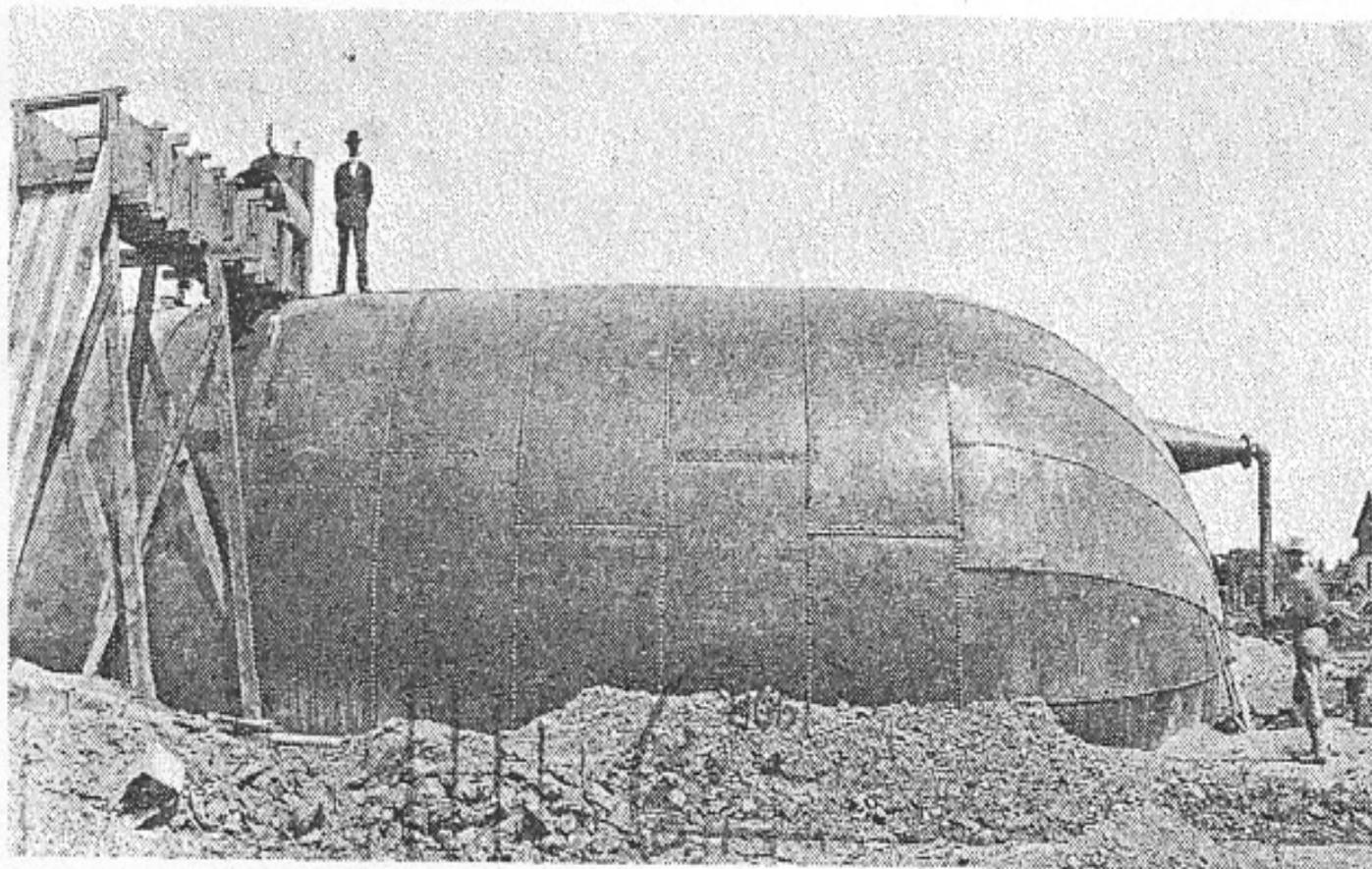
Inyan Kara Group (Fall River & Lakota Sandstone)

Igneous and Metamorphic Rock



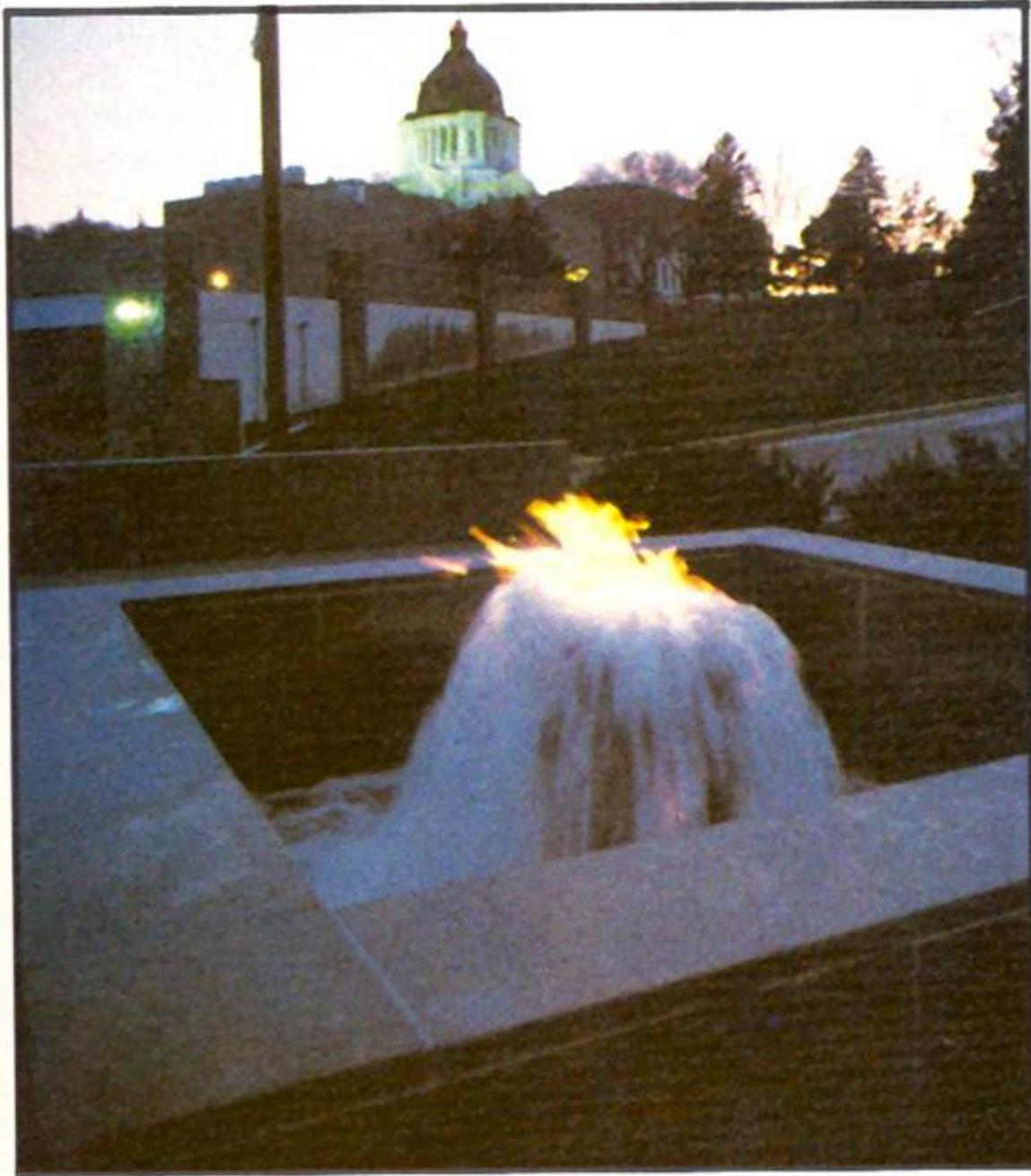
"Shuddering in" Oil Well, Stanley Co. S.D.
June 17th 1921. R.L. Kelly, Photo.





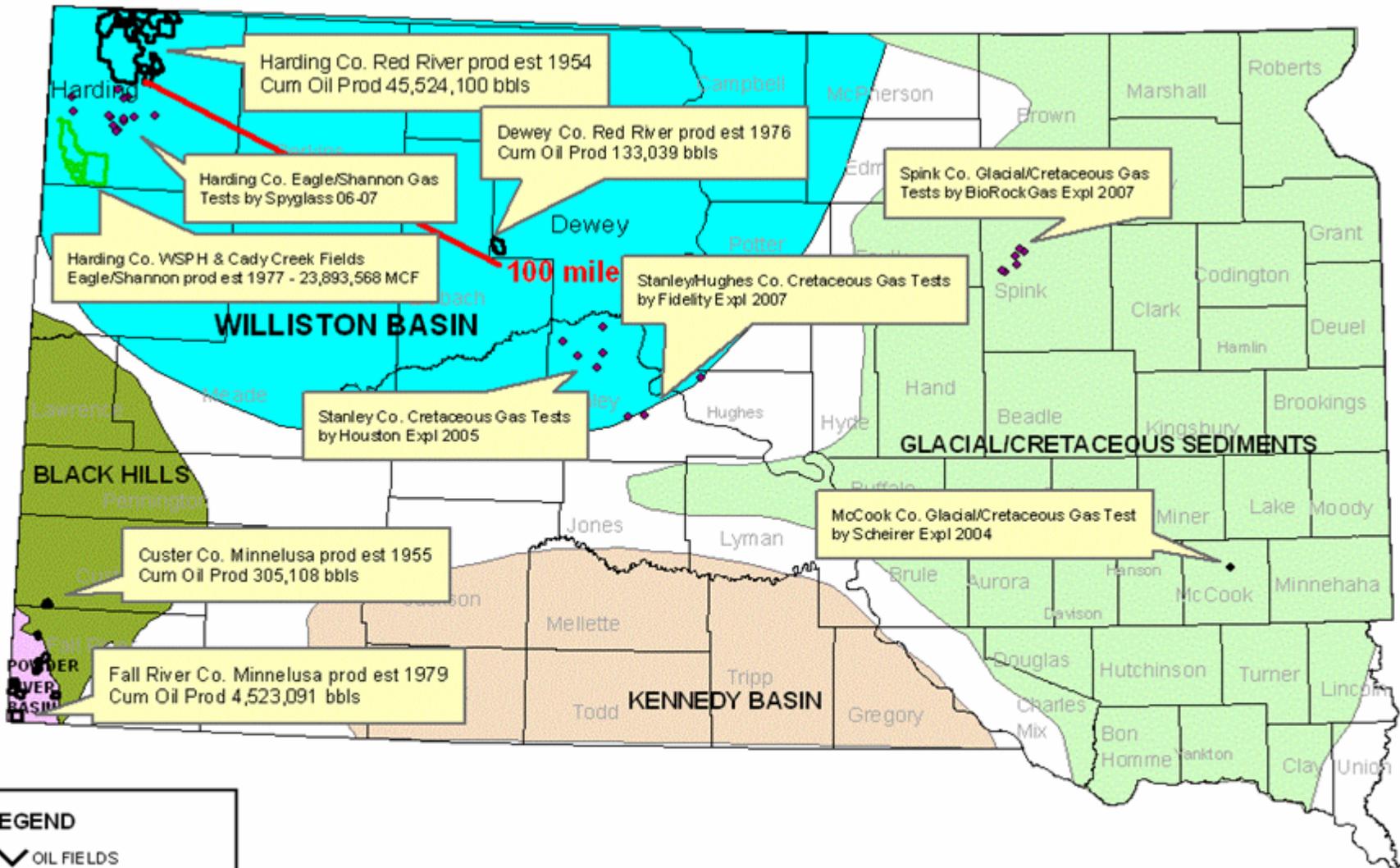
**Tank for natural gas separated from artesian water
in Fort Pierre, 1908.**

(Photo courtesy of Robert E. Kolbe collection)



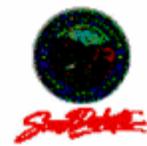
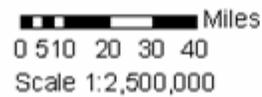
HARDING COUNTY OIL & GAS FIELDS HISTORY

CURRENT AND POTENTIAL OIL & GAS PRODUCING BASINS/AREAS IN SOUTH DAKOTA



LEGEND

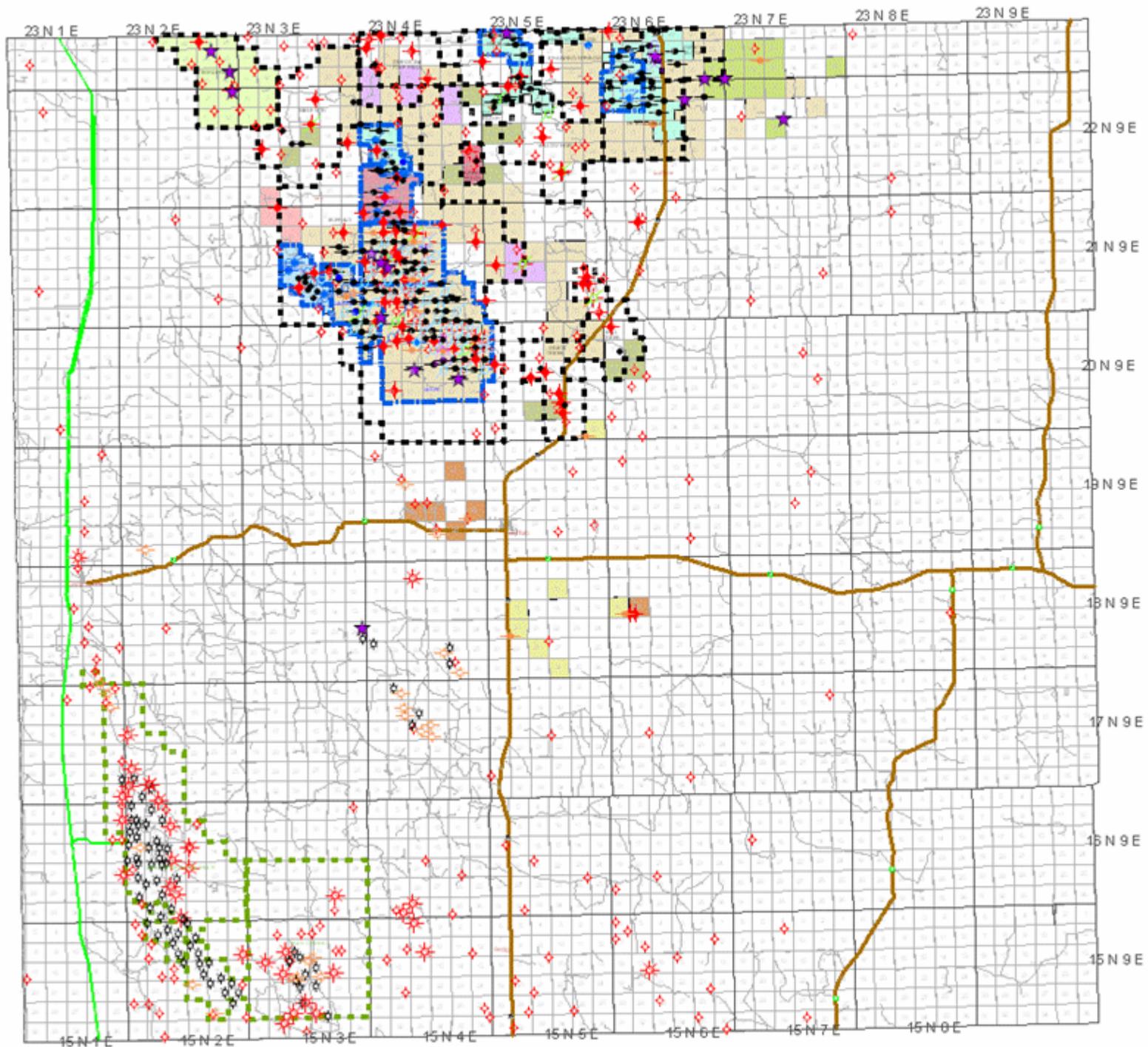
- OIL FIELDS
- GAS FIELDS
- WILLISTON BASIN
- POWDER RIVER BASIN
- BLACK HILLS
- KENNEDY BASIN
- GLACIAL/CRETACEOUS
- GAS WELL TESTS



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HARDING COUNTY OIL & GAS FIELDS HISTORY CONTD.

- **1954: Buffalo Field discovered. Cum gas production 172 BCF, mostly casinghead gas (low BTU) used on site or vented.**

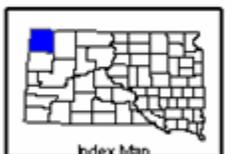


Harding County Oil and Gas Wells/Tests

| | |
|----------------------|-------------------------|
| ☆ New Permits | ■ OIL AND GAS RESOURCES |
| ○ New Drills | □ CONTINENTAL RES |
| ● Converted to Water | □ OILY |
| ● Producing | □ OIL ENERGY |
| ○ SUTA | □ OIL |
| ● Producing | □ GAS |
| ○ SUTA | □ OIL AND GAS |
| ● Producing | □ OIL ENERGY |
| ○ SUTA | □ OIL ENERGY |
| ● Producing Wells | □ OIL ENERGY |
| ○ SUTA | □ OIL ENERGY |
| ○ Air | □ OIL ENERGY |
| ○ Air HORIZONTAL | □ OIL ENERGY |
| ○ SRO | □ OIL ENERGY |
| ○ Water HORIZONTAL | □ OIL ENERGY |
| ○ Water INJ | □ OIL ENERGY |
| ○ Water SUPPLY WELL | □ OIL ENERGY |
| ○ Producing | □ OIL ENERGY |
| ○ SUTA | □ OIL ENERGY |
| ○ SUTA | □ OIL ENERGY |



1:400,000



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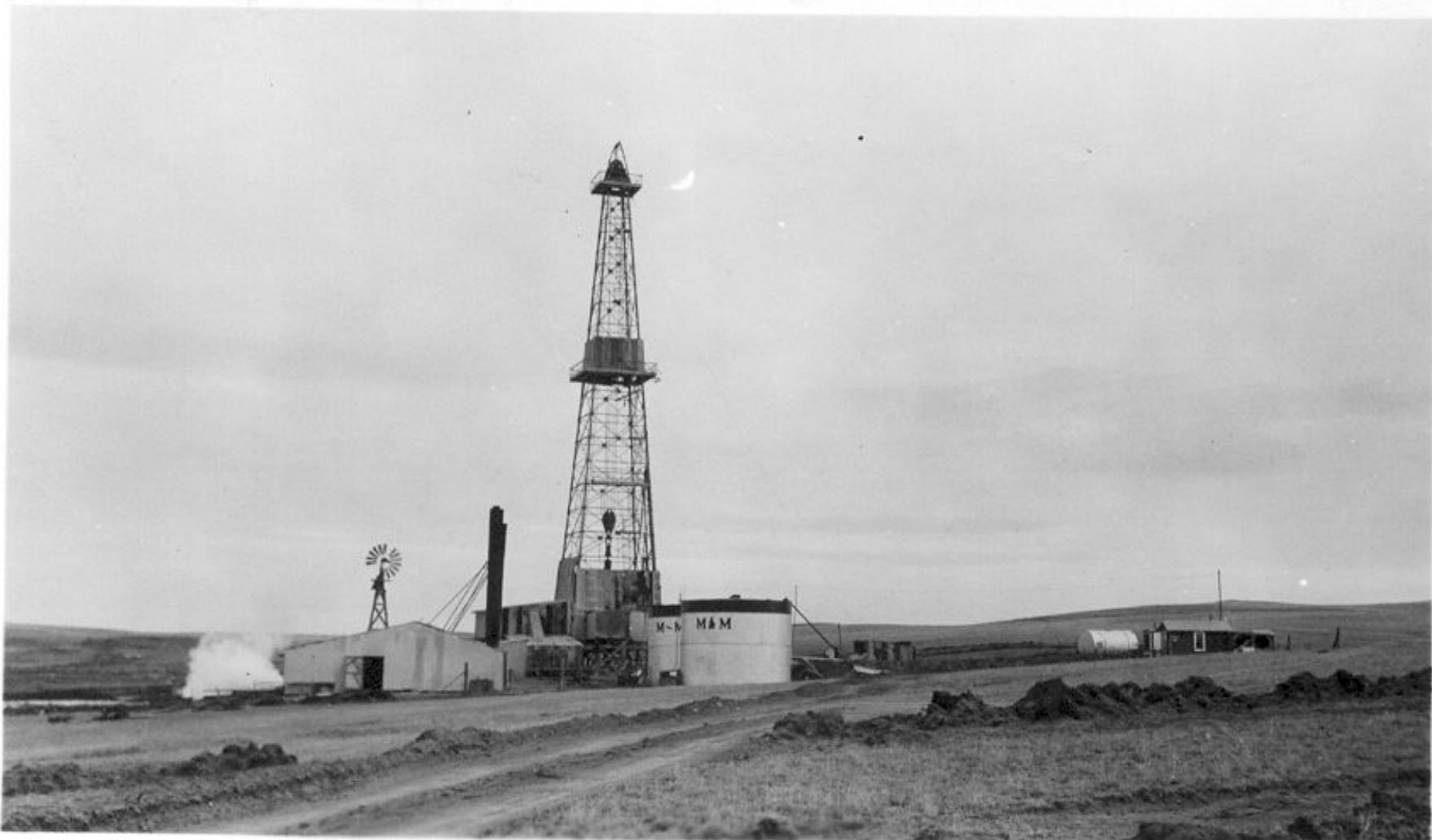


Compiled by Mark McGivray, October 2015

HARDING COUNTY – BUFFALO FIELD 1943



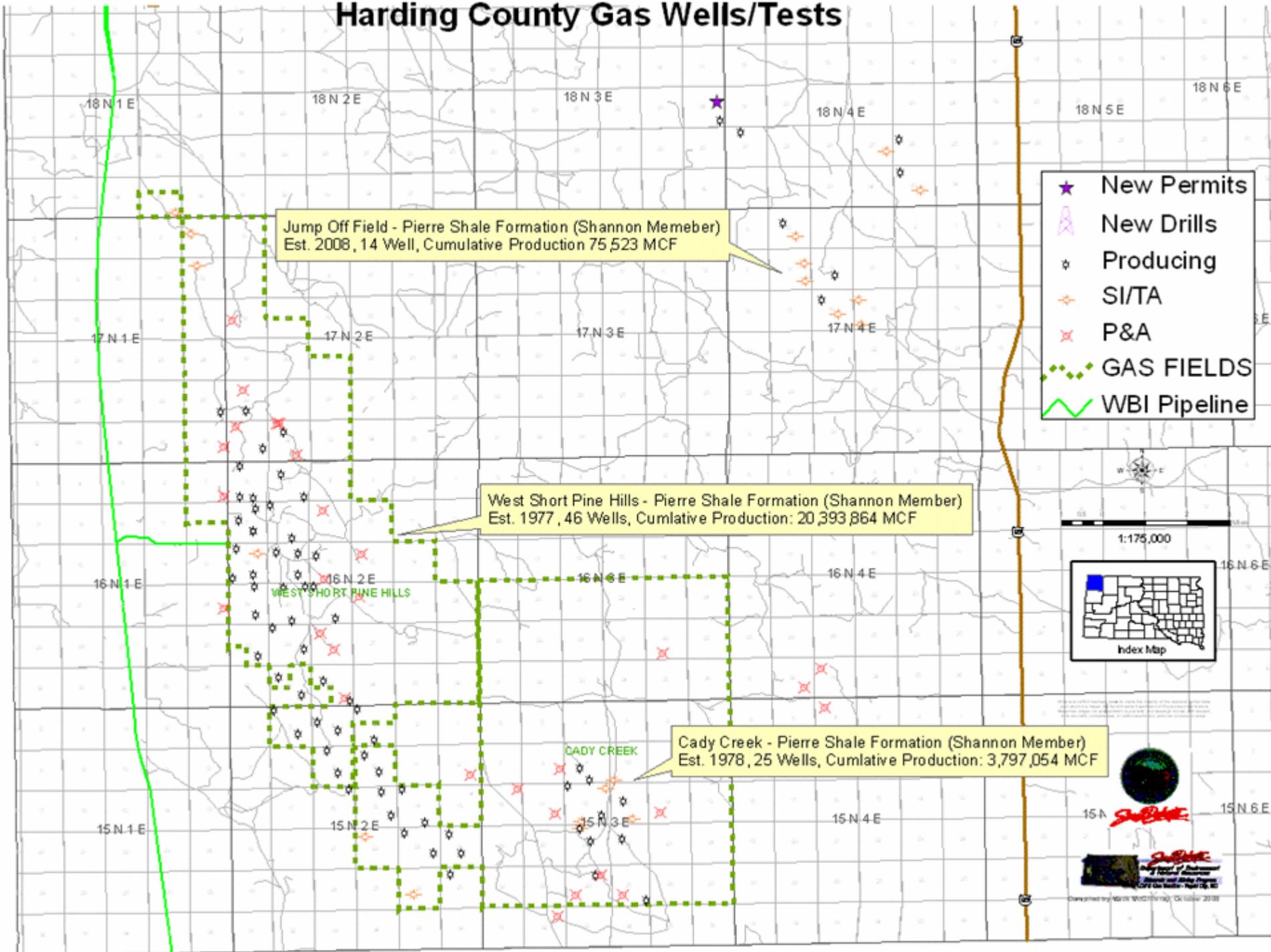
HARDING COUNTY – BUFFALO FIELD 195?



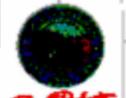
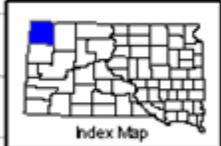
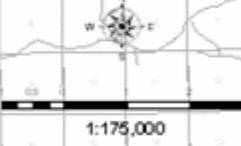
HARDING COUNTY OIL & GAS FIELDS HISTORY CONTD.

- **1976-78: West Short Pine Hills & Cady Creek fields discovered. Cum gas production 24 BCF, all salable gas**

Harding County Gas Wells/Tests

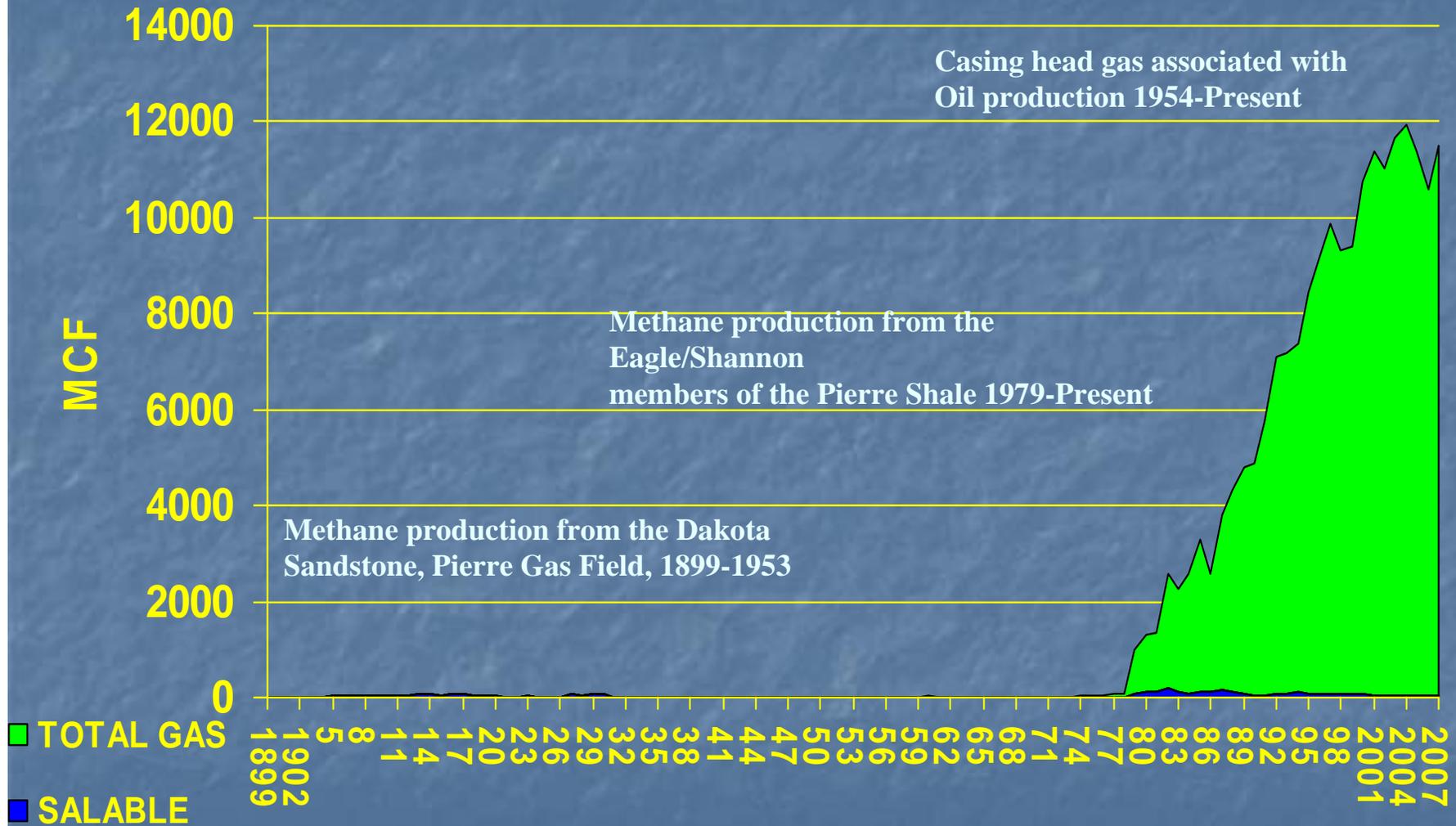


- ★ New Permits
- ◊ New Drills
- Producing
- ◇ SI/TA
- ✕ P&A
- GAS FIELDS
- WBI Pipeline

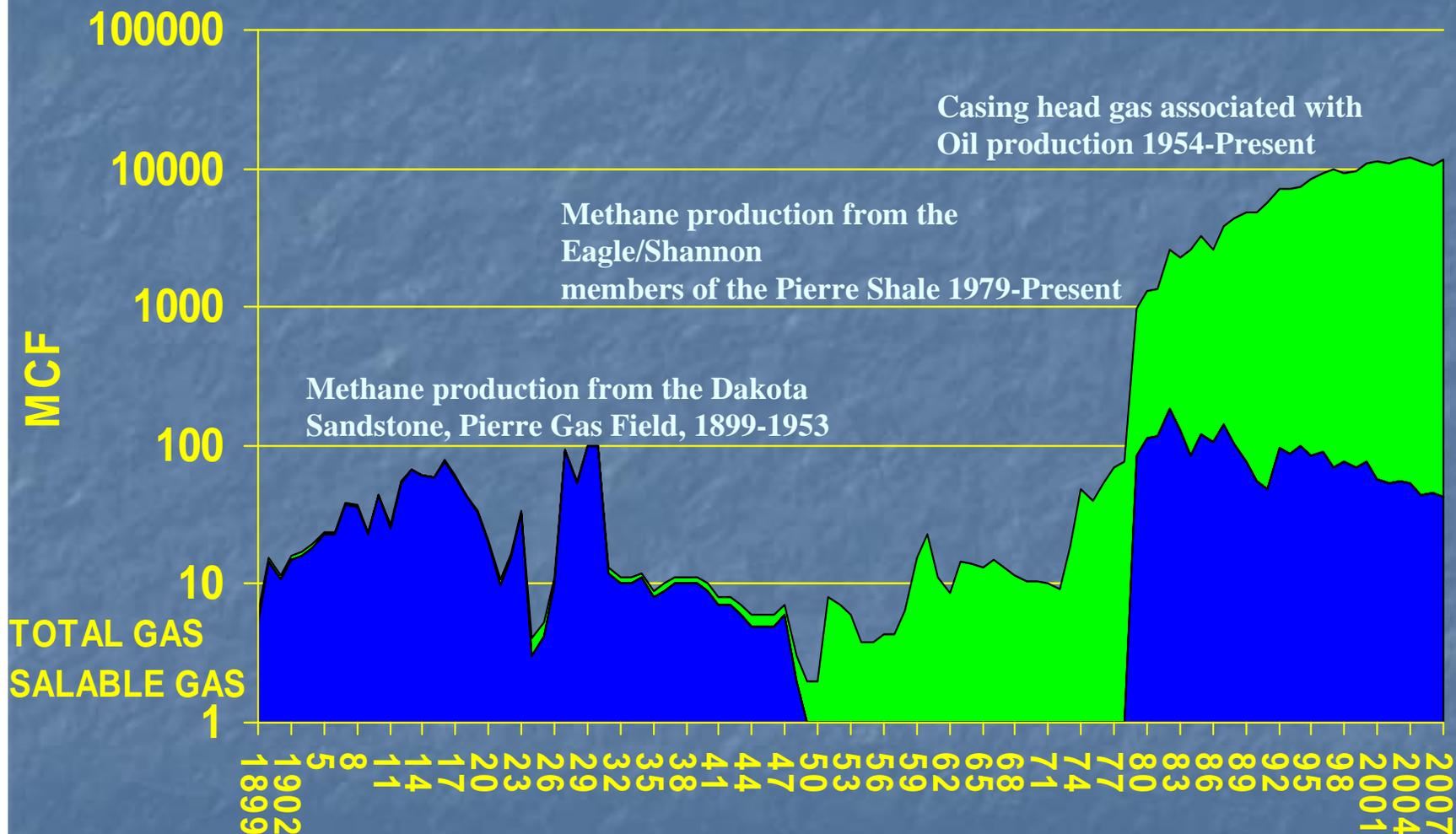


Prepared by Mark McElroy, GIS Unit 2010

South Dakota Natural Gas Production 1899 - 2007



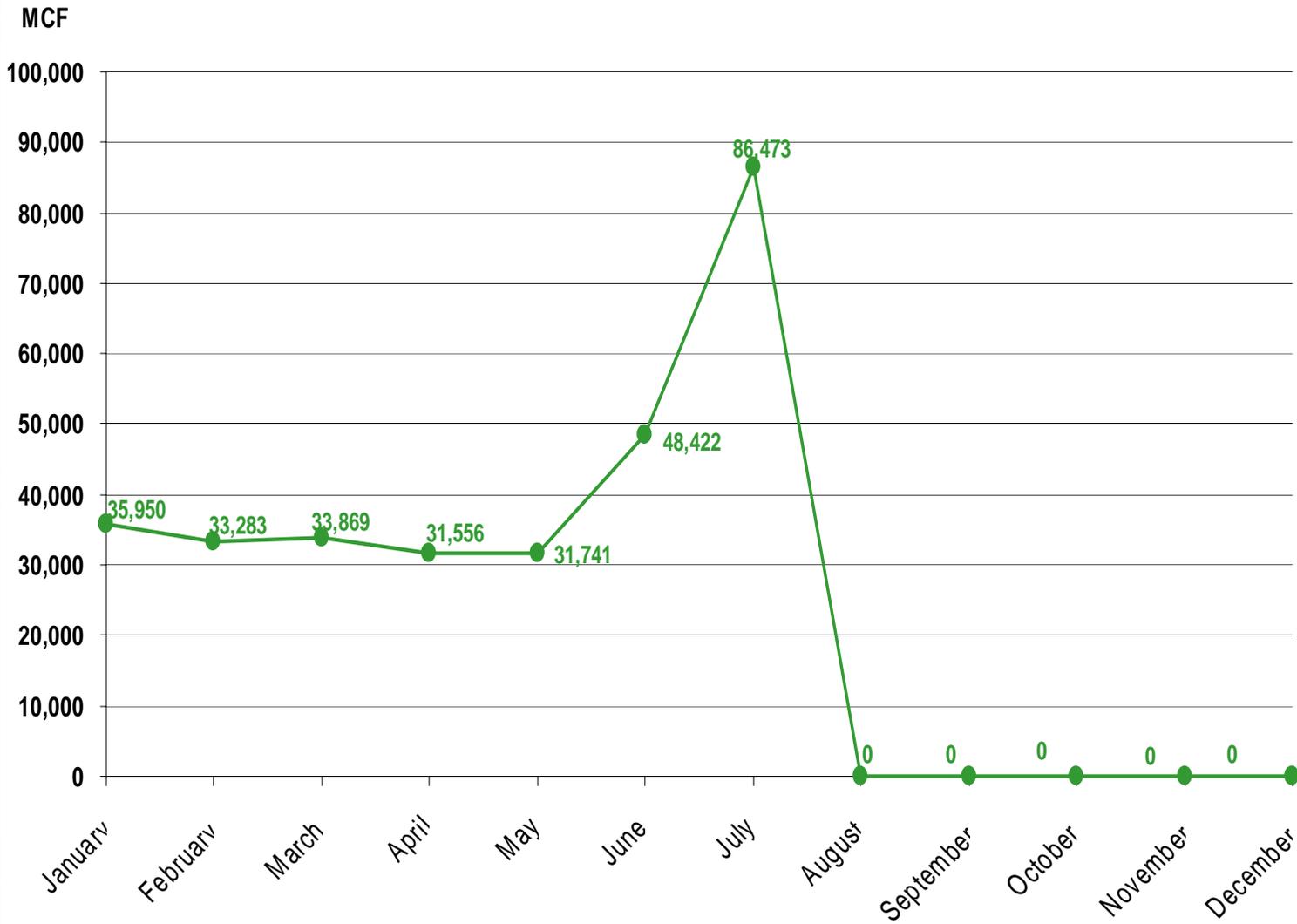
South Dakota Natural Gas Production 1899 - 2007



HARDING COUNTY OIL & GAS FIELDS HISTORY CONTD.

- 2007-08: Spyglass Jump Off Field discovered. Cum gas production (June & July 2008, 50 days) 75,523 MCF

2008 MONTHLY SALABLE GAS PRODUCTION





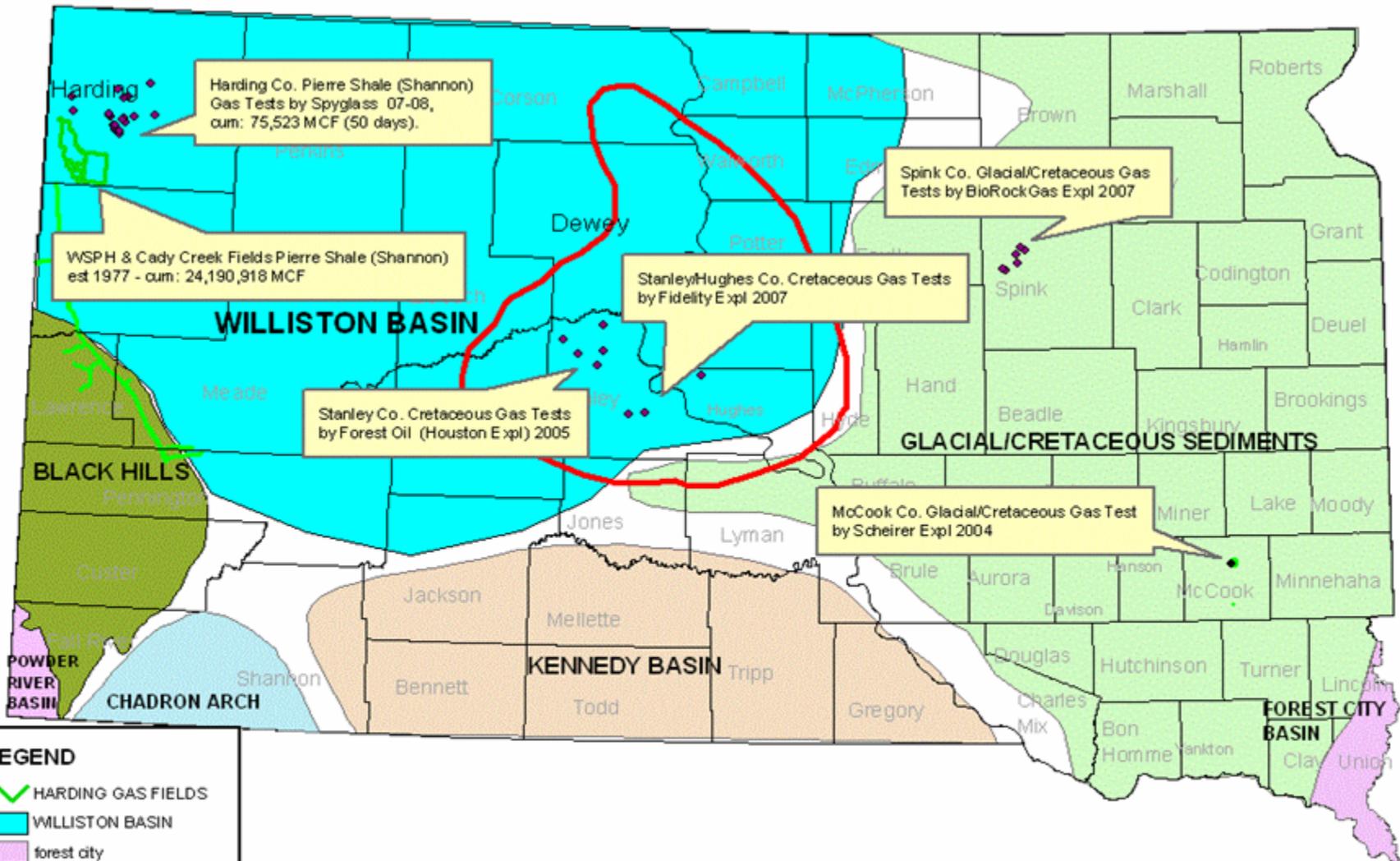




RECENT "WILDCAT" SHALLOW GAS EXPLORATION

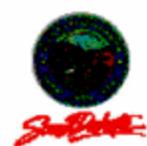
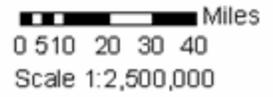
- 2004: McCook Co. Glacial/Cretaceous Test by Sheirer (Landowner). Show of Gas, but also producing water. Still testing methods to reduce

CURRENT AND POTENTIAL GAS PRODUCING BASINS/AREAS IN SOUTH DAKOTA



LEGEND

- HARDING GAS FIELDS
- WILLISTON BASIN
- forest city
- chadron arch
- PIERRE GAS FIELD
- POWDER RIVER BASIN
- BLACK HILLS
- KENNEDY BASIN
- GLACIAL/CRETACEOUS
- GAS WELL TESTS



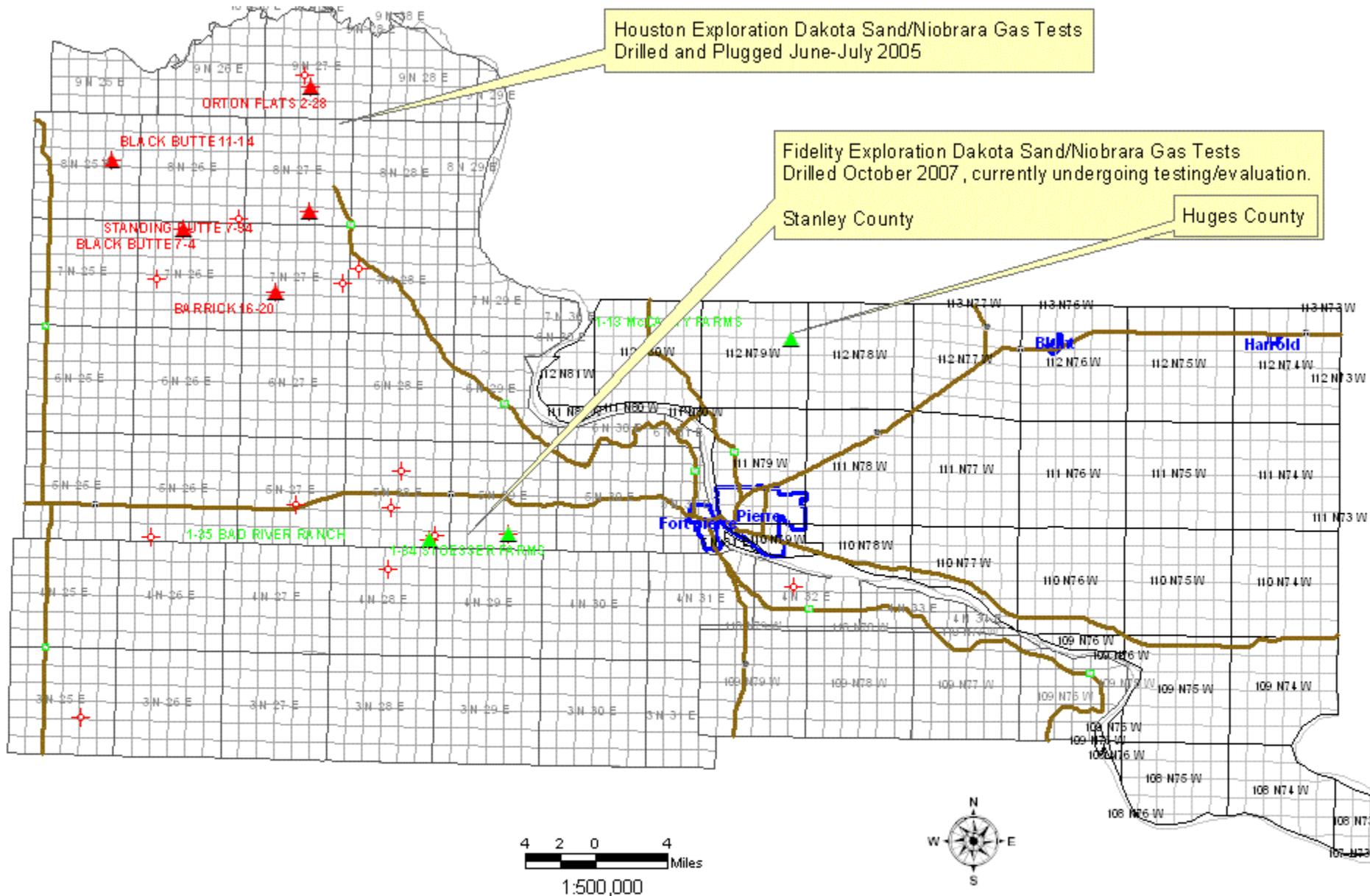
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 & Natural Resources
 Minerals and Mining Program
 Oil & Gas Section - Rapid City, SD
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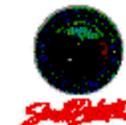
RECENT "WILDCAT" SHALLOW GAS EXPLORATION CONTD.

- 2005 & 2007: Stanley & Hughes Co. Cretaceous Gas Tests by Huston Expl (Forest Oil) & Fidelity Expl.



- ▲ FIDELITY GAS TEST
- ▲ FOREST GAS TEST
- + PLUGGED GAS TEST
- ▭ CITIES/TOWNS

While every effort has been made to insure the integrity of this map and factual data upon which it is based, the South Dakota Department of Environment and Natural Resources makes no representation or warranty, expressed or implied, with respect to its accuracy, completeness, or usefulness for any particular purpose or scale.



Compiled by Mack McGillivray

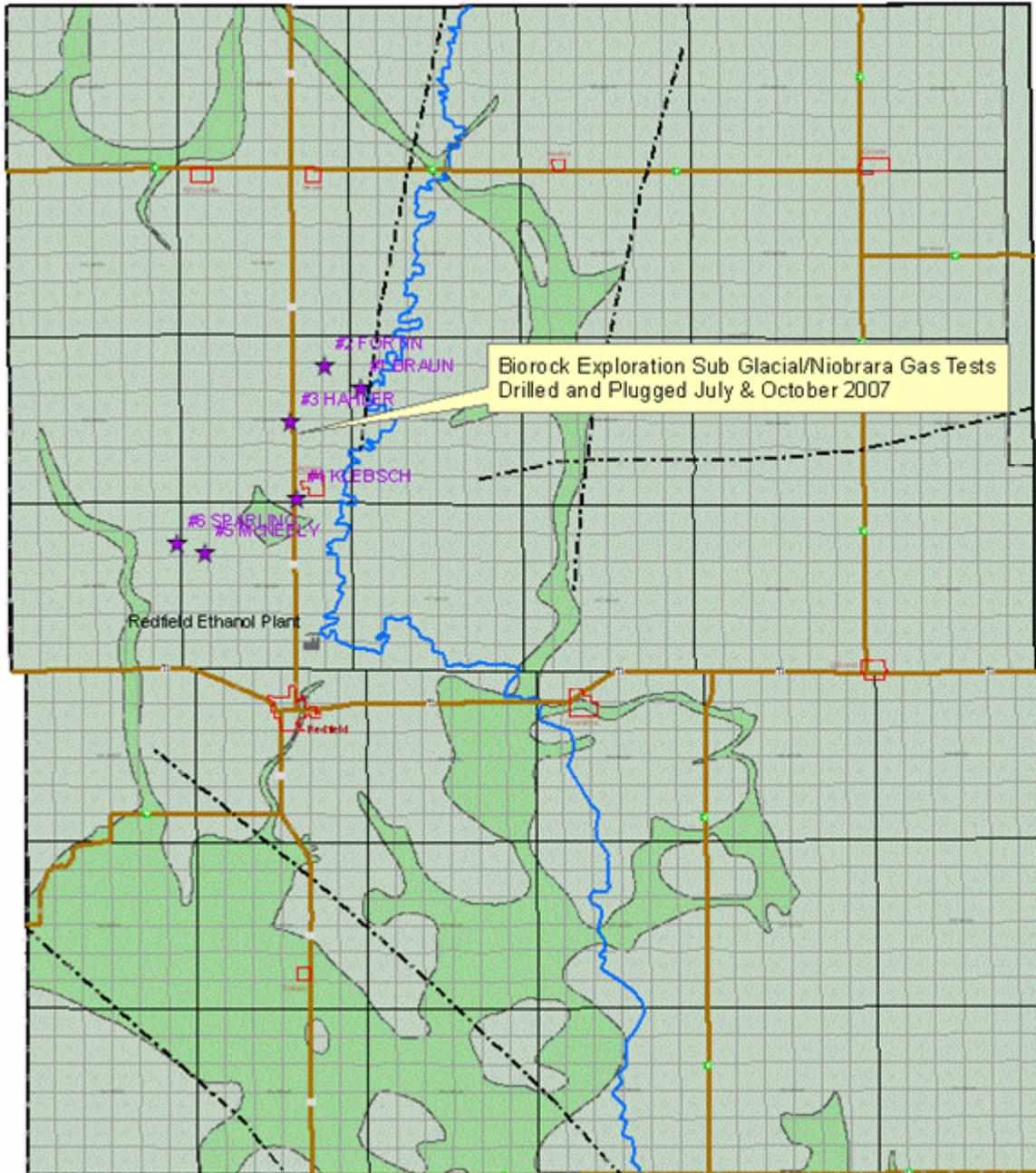




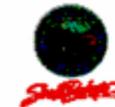
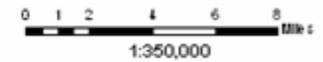
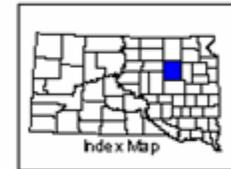
RECENT "WILDCAT" SHALLOW GAS EXPLORATION CONTD.

- **2007: Spink Co. Cretaceous Gas Tests
by BioRock.**

Spink County Gas Tests



| | | | |
|--|------------------------|--|--------------|
| | Plugged & Abandoned | | Cities/Towns |
| | Redfield Ethanol Plant | | Biodock |
| | Biorock Gas Tests | | Formation |
| | Highways | | Niobrara |
| | Lineaments | | Pierre Shale |
| | James River | | |



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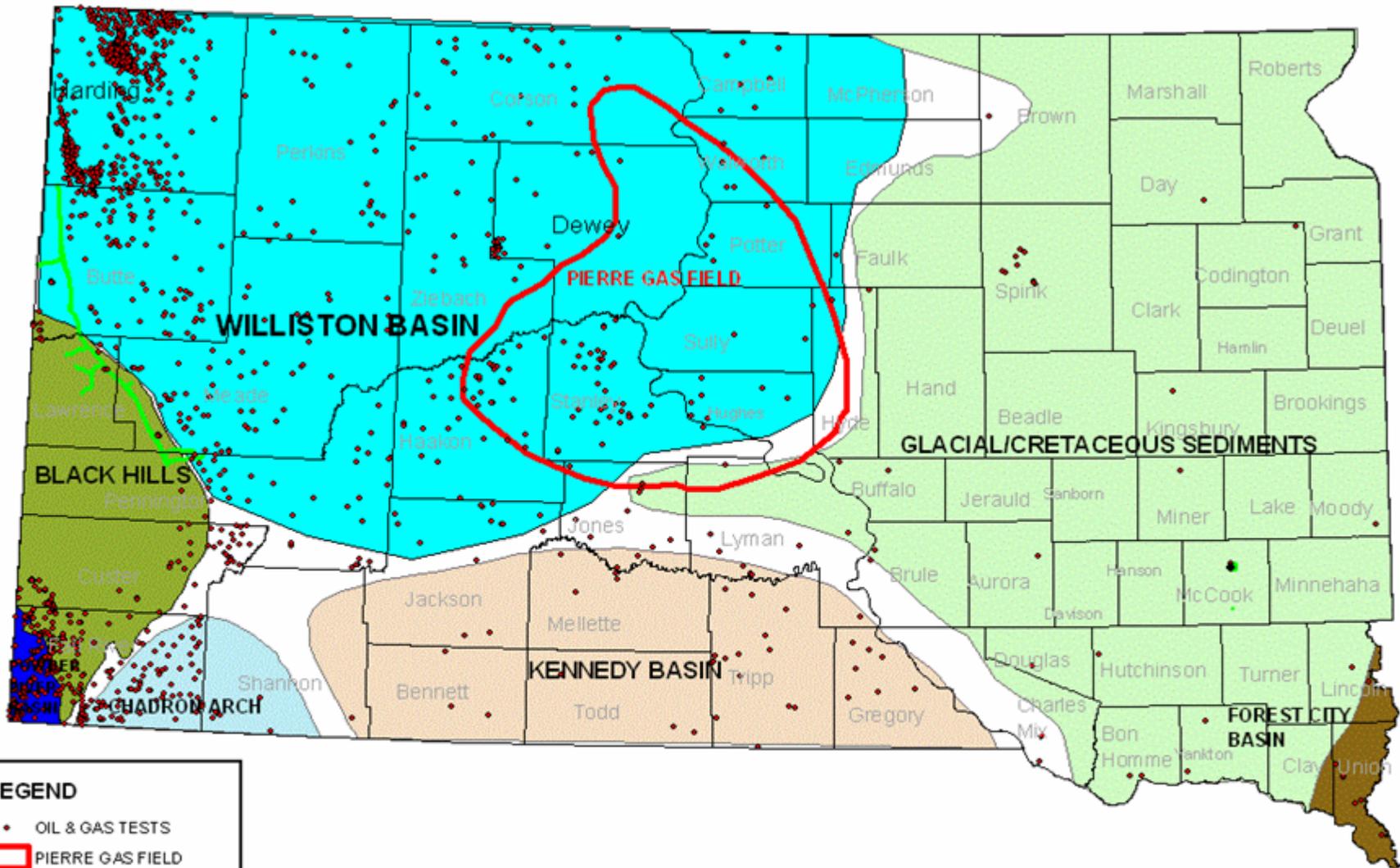






*THE FUTURE,
WHAT DOES IT
HOLD, AND
WHAT CAN WE
DO TO HELP?*

CURRENT AND POTENTIAL OIL & GAS PRODUCING BASINS/AREAS IN SOUTH DAKOTA

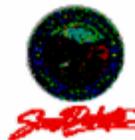


LEGEND

- OIL & GAS TESTS
- PIERRE GAS FIELD
- FOREST CITY BASIN
- CHADRON ARCH
- KENNEDY BASIN
- GLACIAL/CRETACEOUS
- BLACK HILLS
- POWDER RIVER BASIN
- WILLISTON BASIN



Miles
0 10 20 30 40
Scale 1:2,500,000



South Dakota
Department of Environment
& Natural Resources
Minerals and Mining Program
Oil & Gas Section - Rapid City, SD
BY FRED STEECE AND MACK MCGILLIVRAY

***CURRENT
PUBLICATIONS
AND
SERVICES***



DEPARTMENT OF GEOLOGY
 UNIVERSITY OF SOUTH DAKOTA
 415 EAST BRADLEY AVENUE
 SIOUX FALLS, SOUTH DAKOTA 57105
 605/673-3333

GEOLOGIC MAP OF SOUTH DAKOTA

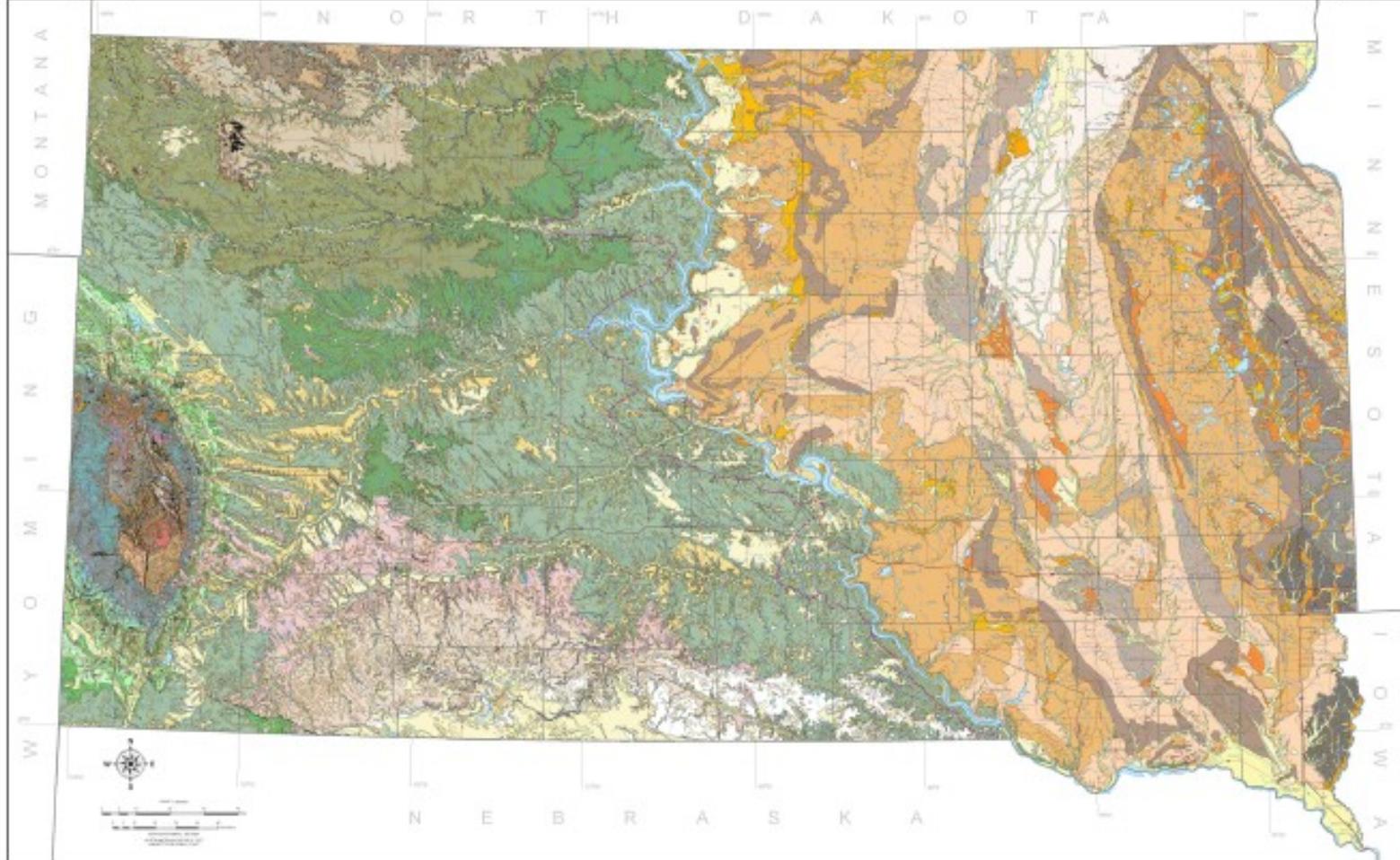
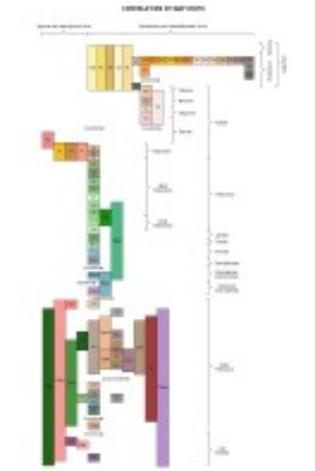
BY
 A. F. HAYES, A. F. KEMP, R. B. FARRERMAN,
 & W. S. COOK, L. J. SELLER

1900-1901

U.S. GEOLOGICAL SURVEY

Geological Map of South Dakota

Scale 1:500,000



DESCRIPTION OF MAP UNITS

| | | | |
|--|--|--|---|
| 1 Precambrian gneiss and schist, including the Black Hills and the Black Hills Pluton. | 10 Upper Cretaceous sandstone and shale, including the Pierre and Fort Pierre formations. | 19 Lower Cretaceous sandstone and shale, including the Pierre and Fort Pierre formations. | 28 Upper Paleozoic sandstone and shale, including the Pierre and Fort Pierre formations. |
| 2 Precambrian granite and gneiss, including the Black Hills and the Black Hills Pluton. | 11 Upper Cretaceous sandstone and shale, including the Pierre and Fort Pierre formations. | 20 Lower Cretaceous sandstone and shale, including the Pierre and Fort Pierre formations. | 29 Upper Paleozoic sandstone and shale, including the Pierre and Fort Pierre formations. |
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General Maps



The files provided are relatively large in size and should be downloaded by "right-clicking" the download link and selecting "Save as..."

General Map No. 2: Coal fields of northwestern South Dakota


[Map](#) (14.6 Mb)

General Map No. 3: Panel diagram of subsurface formations in South Dakota


[Map](#) (36.4 Mb)

General Map No. 4: Structure map of South Dakota, Greenhorn datum


[Map](#) (43.7 Mb)

General Map No. 8: Recorded earthquakes in South Dakota


[Map](#) (0.4 Mb)



General Map No. 9: Bedrock geologic map showing configuration of the bedrock surface in South Dakota east of the Missouri River


[Map](#) (12.5 Mb) [Shapefiles](#)



General Map No. 10: Geologic map of South Dakota


[Map](#) (10.6 Mb) [Text](#) (0.1 Mb) [Shapefiles](#)

O&G Dev

RULES & REGS

NEW PERMITS

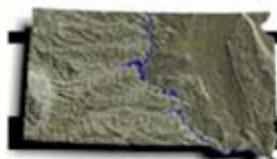
FORMS

PROD/INJ

MAPS

WELL DATA

LINKS



South Dakota
**Department of Environment
& Natural Resources**
Minerals and Mining Program
Oil & Gas Section - Rapid City, SD

Fred Steece - Oil & Gas Supervisor/Geology Specialist ([E-mail](#))

Gerald (Mack) McGillivray - Senior Geologist/Web Page Developer ([E-mail](#))

Welcome to the South Dakota Oil & Gas Section homepage. The Oil & Gas Section is under the [Minerals & Mining Program](#), [Division of Environmental Services](#), [Department of Environment and Natural Resources](#), and is located at 2050 W. Main, Suite #1, Rapid City, SD 57701. PH: (605) 394-2229.

What We Do

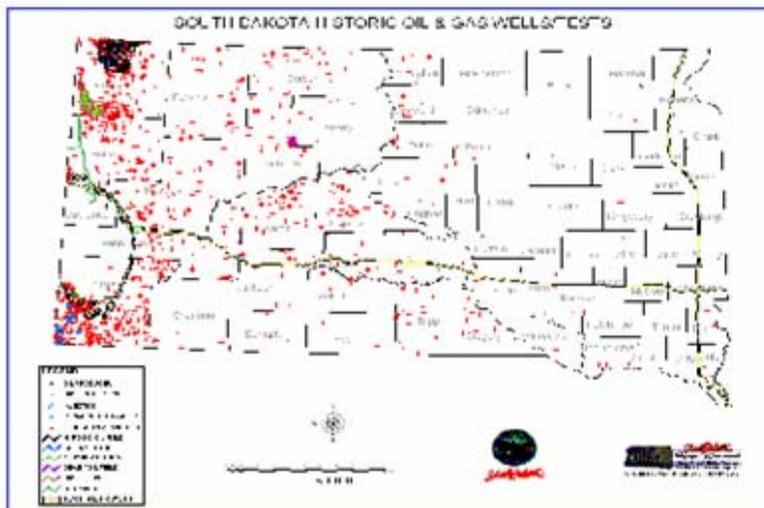
The purpose of the Oil & Gas Section is to provide environmental regulation in a customer service oriented manner, and to promote the development of oil and gas resources in the state in a manner that will prevent waste, encourage the greatest economic recovery of oil and gas, and protect correlative rights, ground water resources, the environment and human health.



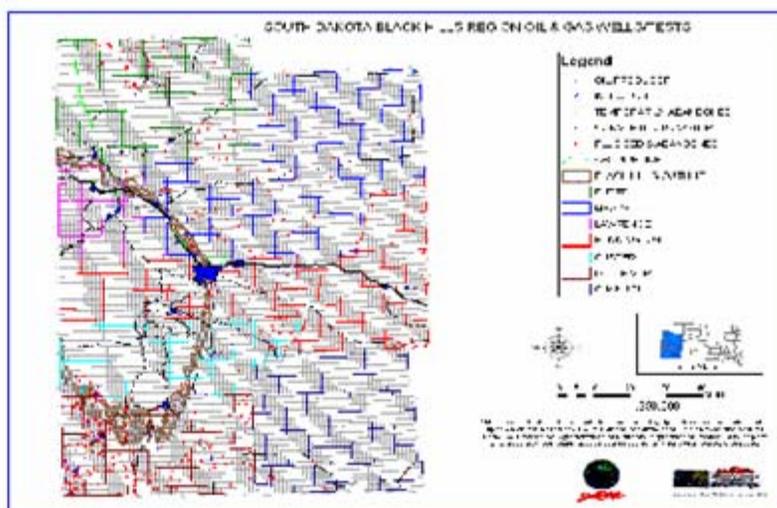
The maps are updated on a monthly, or as needed, basis. They are also available by mail order (including key with well locations and data) from our office. The paper sizes and costs are listed below. Costs for larger scale plots will be determined on a case-by-case basis.

8.5x11 in. \$1.00 - 11x17 in. \$1.25 - 17x22 in. \$2.50 - 22x34 in. \$5.00 - 34x44 in. \$10.00

To order, please contact Mack McGillivray at mack_mcgillivray@state.sd.us or call 605-394-2229.



South Dakota Statewide



Black Hills Region





ENTER SEARCH CRITERIA

Search Tips

| Search Field | | Value |
|--------------|--|----------|
| Well Field | equals | Buffalo |
| | <input type="radio"/> Simple <input checked="" type="radio"/> AND <input type="radio"/> OR | |
| Location | equals | %22N-4E% |

Search Reset

Help on Fields About

Oil and Gas Search for: well_field like 'Buffalo' AND loc like '%22N-4E%'

Page 1 of 2

Print Preview

Export Results

well formation both

Page: Prev 1 Next

Record 1 of 20

Well Information

| | | | |
|-----------------------|-----------------------|--------------------------|----------------|
| API No: | 40 063 20056 | County: | HARDING |
| Well Name: | PHILLIPS 1 B THOMAS | Location: | NWSW 32-22N-4E |
| Permit No: | 659 | Total Depth: | 8790 |
| Operator Name: | PHILLIPS PETROLEUM CO | Bottom Hole: | Red River |
| Permit Date: | 1972-05-02 | KB Elevation: | 3046 |
| Spud Date: | 1972-06-03 | Ground Elevation: | 3034 |
| Plug Date: | 1982-08-18 | Latitude: | 45.825545 |
| | | Longitude: | -103.661939 |
| Well Field | BUFFALO | Status | P&A |
| Class: | OIL | Type: | |

Formation Tops

| <u>Formation</u> | <u>Depth (ft.)</u> |
|------------------|--------------------|
| Piper | 5316 |
| Pine Salt | 5602 |
| Minnekahta | 5944 |
| Opeche | 5990 |
| Minnelusa | 6099 |
| 1st Leo | 6256 |

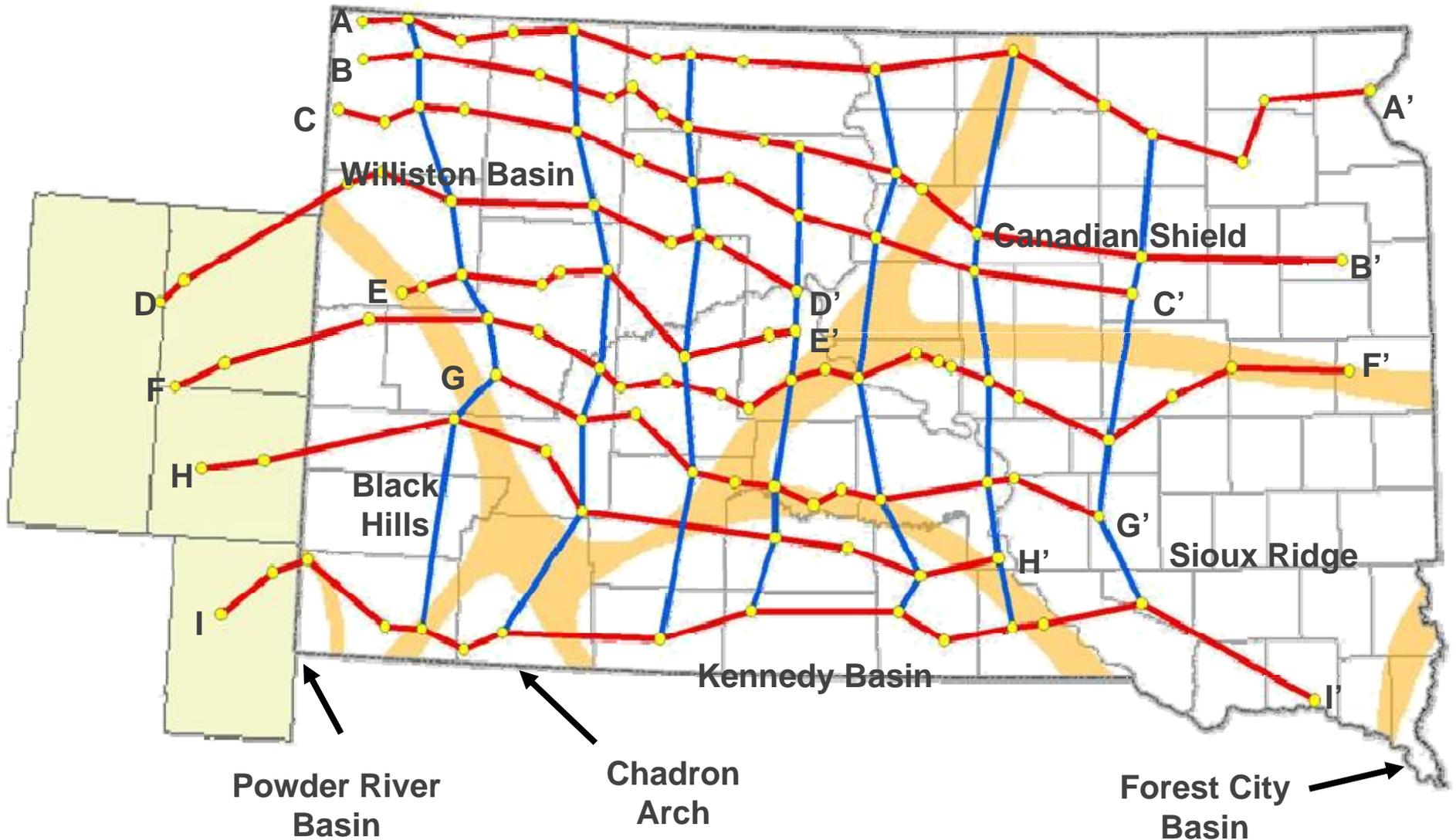
NEW STUFF!!

REVISED RULES

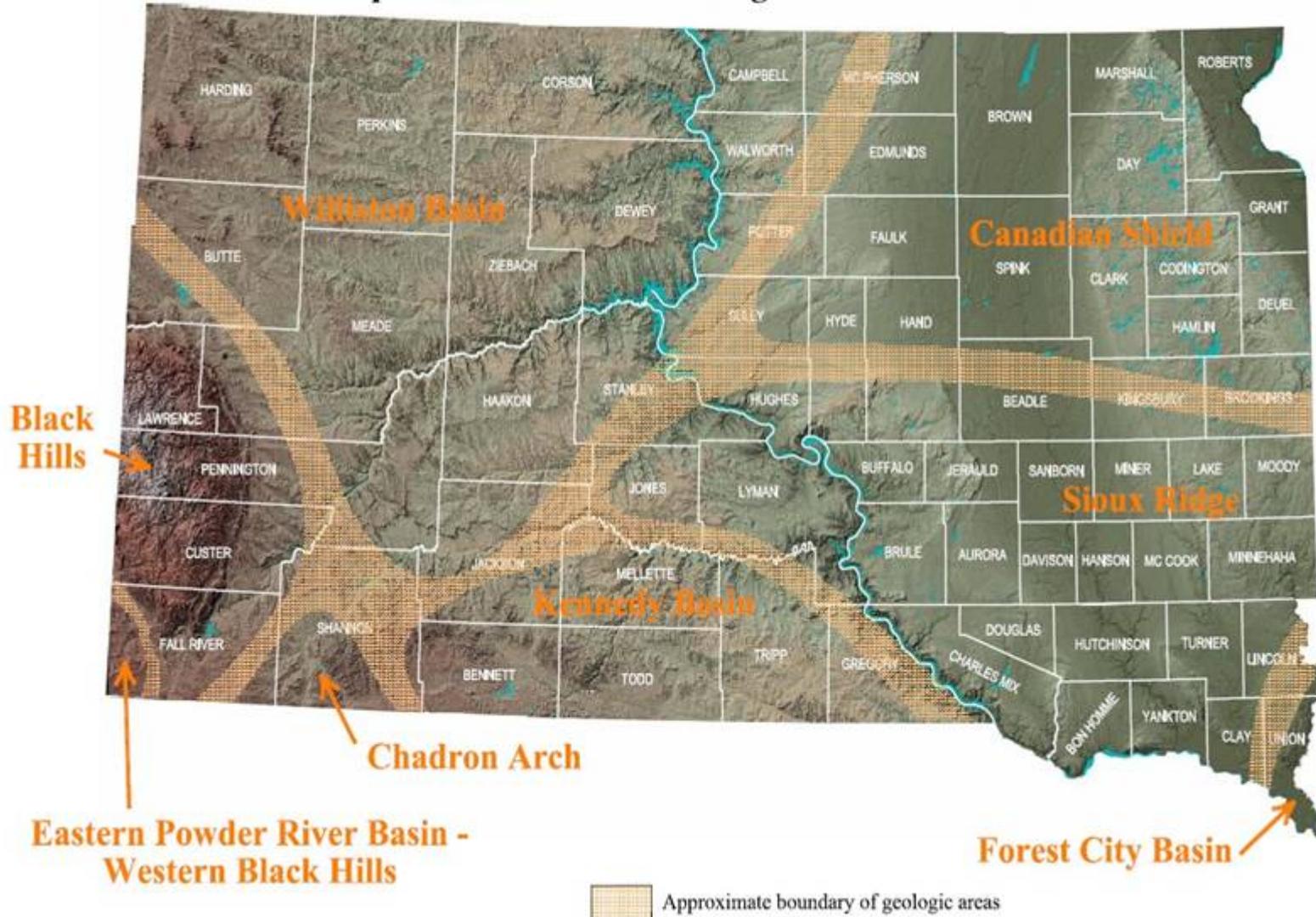
Revise 74:10:03:16. Procedures for setting surface casing and production casing.

The rule currently requires a minimum of 100 feet of surface casing to protect shallow aquifers in all oil and gas wells. Operators that are exploring for shallow oil and gas in the state asked the department to change the current rule because some of the oil and gas they are targeting is at depths of less than 100 feet. In addition, there are areas in the state where 100 feet of surface casing is not necessary due to the surface geology (shale, glacial till). This rule change will eliminate the minimum 100 feet of surface casing requirement and allow the department to determine how much surface casing is required on a case-by-case basis as we do now when more than 100 feet is required.

Cross Sections of Geophysical Logs of Phanerozoic Rocks in South Dakota



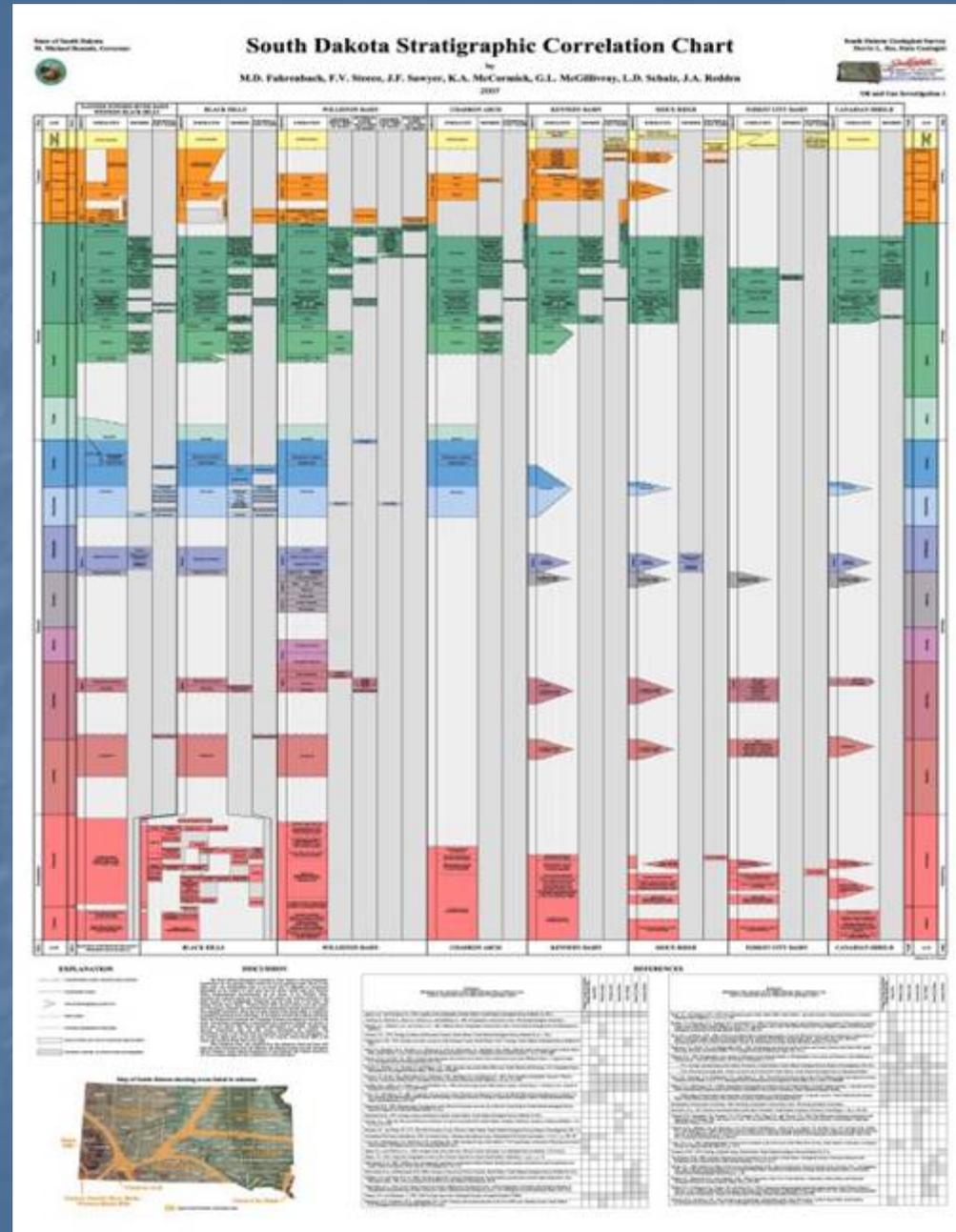
Map of South Dakota showing areas listed in columns



Stratigraphic Correlation Chart of South Dakota

Joint effort by DENR
Oil & Gas Section
And
South Dakota Geological Survey

Became available
as a SDGS publication
(Oil & Gas Investigation 1)
July, 2007



*THE DENR OIL & GAS OFFICE AND SDGS HAVE
SCANNED ALL OF THE WELL LOGS IN OUR FILES,
AND THEY ARE CURRENTLY AVAILABLE IN TIFF
AND PDF FORMATS BY REQUEST.*

HOPEFULLY, THEY WILL BE AVAILABLE ON THE WEB SOON.



BW Mode



*Gamma Ray
Neutron*

NO. 659

COMPANY PHILLIPS PETROLEUM COMPANY

WELL THOMAS "B" NO. 1

FIELD BUFFALO

COUNTY HARDING STATE SOUTH DAKOTA

LOCATION: 850' FML - 1900' FSL 12

SEC 32 TWP 22N RGE 4E

ACBL -
SIGNATURE

BH FLANGE

Elevations:
KB 3045
DF 3045
GL 3034

Permanent Datum Measured from KB 12 F. Above Permanent Datum

No. 7-11-72

Log 6/R - N/N

Driller 8790 South Dakota Geological Survey

Logger 8748 Western Field Office

Logged Interval SURFACE 308 West Blvd. Rapid City, S. Dak. 57703

Fluid in Hole WATER

Fluidity Ppm Cl. FRESH

Density Lb./Gal. 824

Rec. Temp. Deg. F 4 HOURS

Recorded By BAKER

Checked By MR. RATCLIFF

MR. MITCHELL

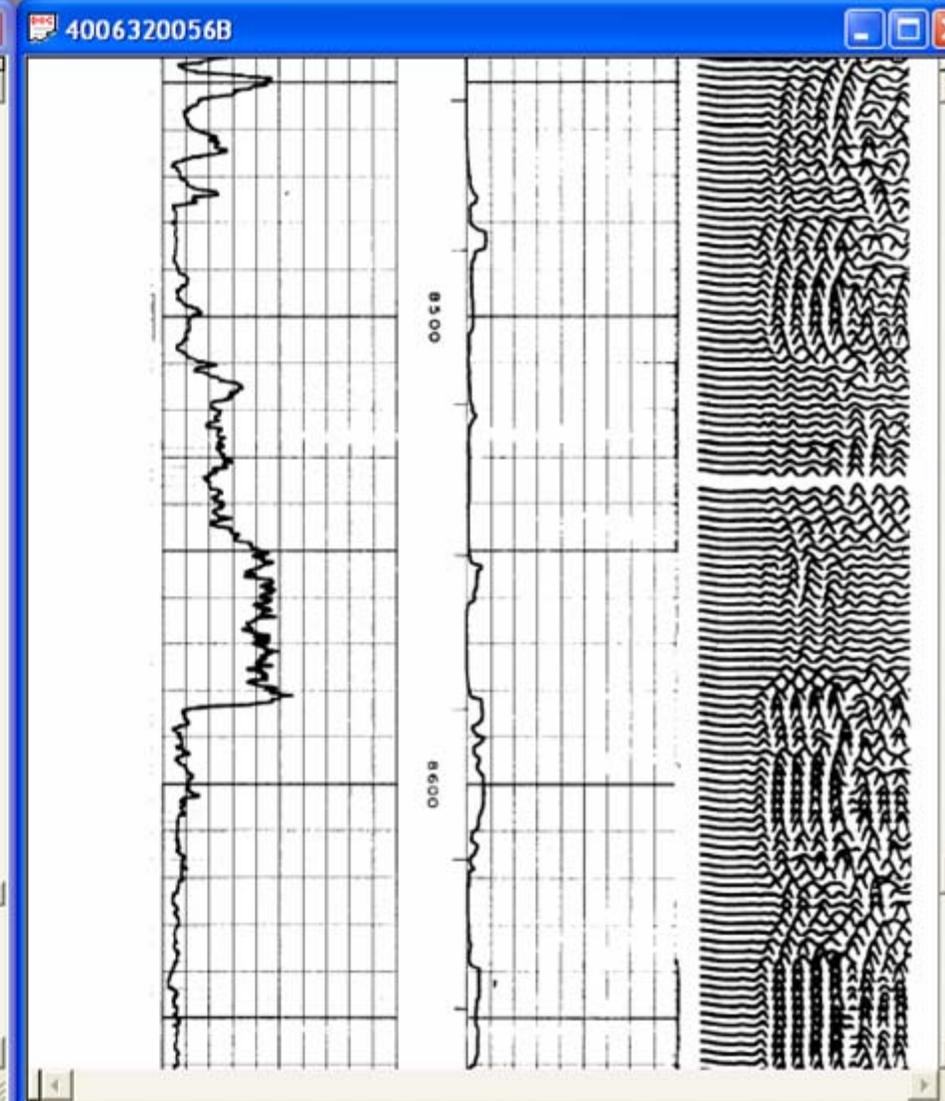
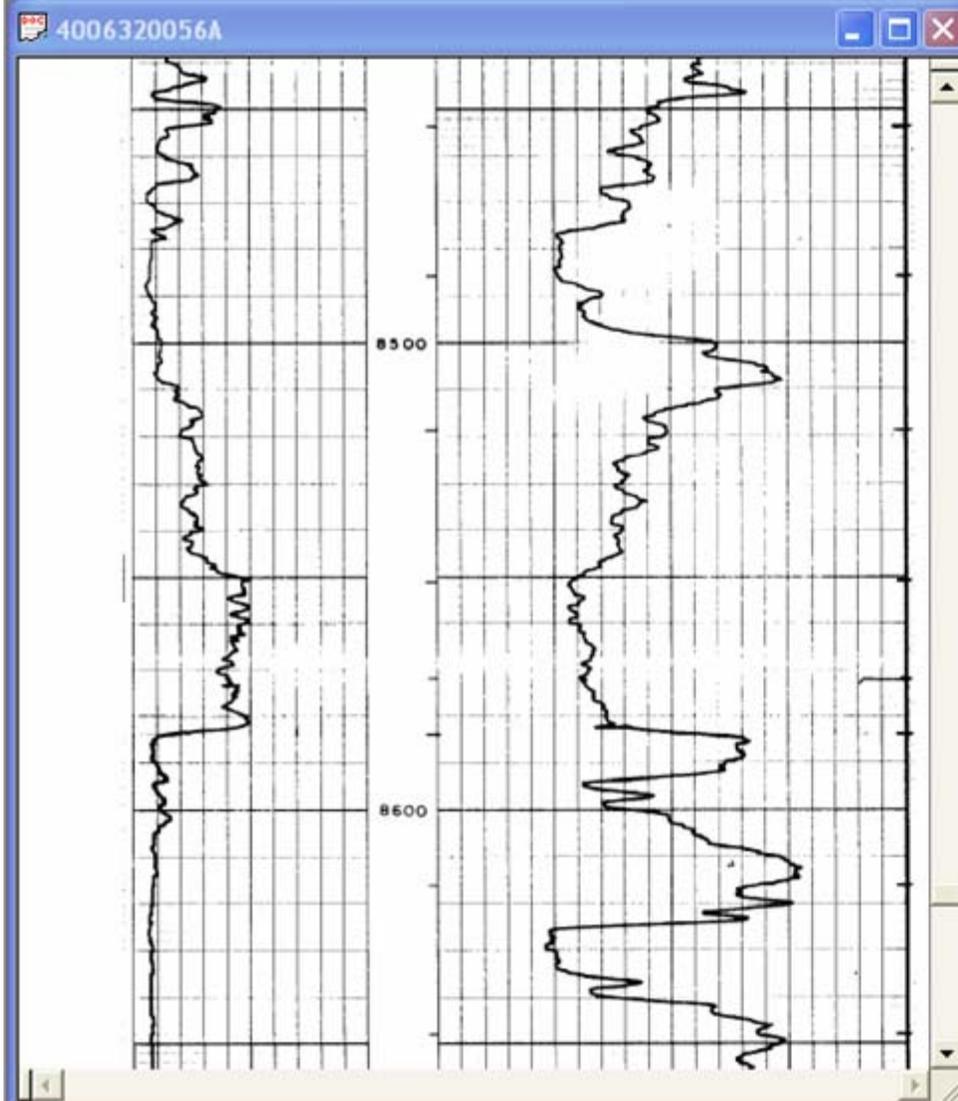
| Bore Hole Record | | Casing Record | | | | |
|------------------|------|---------------|-------|------|---------|------|
| Bit | From | To | Size | Wgt. | From | To |
| 1 7 7/8 | | | 5 1/2 | 17 | SURFACE | 8778 |

FULL HERE

| Gamma Ray | | Equipment Data | | Neutron | |
|-------------------|--------|-------------------|--------|-------------------|--------|
| Run No. | ONE | Run No. | ONE | Run No. | ONE |
| Tool Model No. | 2403 | Log Type | N-EN | Tool Model No. | 2403 |
| Diam. | 3 1/2" | Tool Model No. | 2403 | Diam. | 3 1/2" |
| Detect. Model No. | D6G4 | Diam. | 3 1/2" | Detect. Model No. | D6N3 |
| Type | SCINT. | Detect. Model No. | D6N3 | Type | SCINT. |
| Length | 6" | Type | SCINT. | | |



BW Mode



FOR MORE INFORMATION,

SEE OUR WEBSITE <http://www.state.sd.us/denr/DES/Mining/Oil&Gas/O&Ghome.htm>

OR CONTACT:

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