Northern Rockies Oil and Gas Roundup

November 30, 2010

10:00 am – 12:00 pm

Agenda

-Lynn Helms

North Dakota Oil and Gas Division

-David Galt

Montana Petroleum Association

-Colby Drechsel

Wyoming Pipeline Authority

Tips For Viewers

-Q&A tab at the top of screen for questions

-Close all other applications on your computer: Outlook, etc

This meeting is being recorded and will be available at: www.pipeline.nd.gov

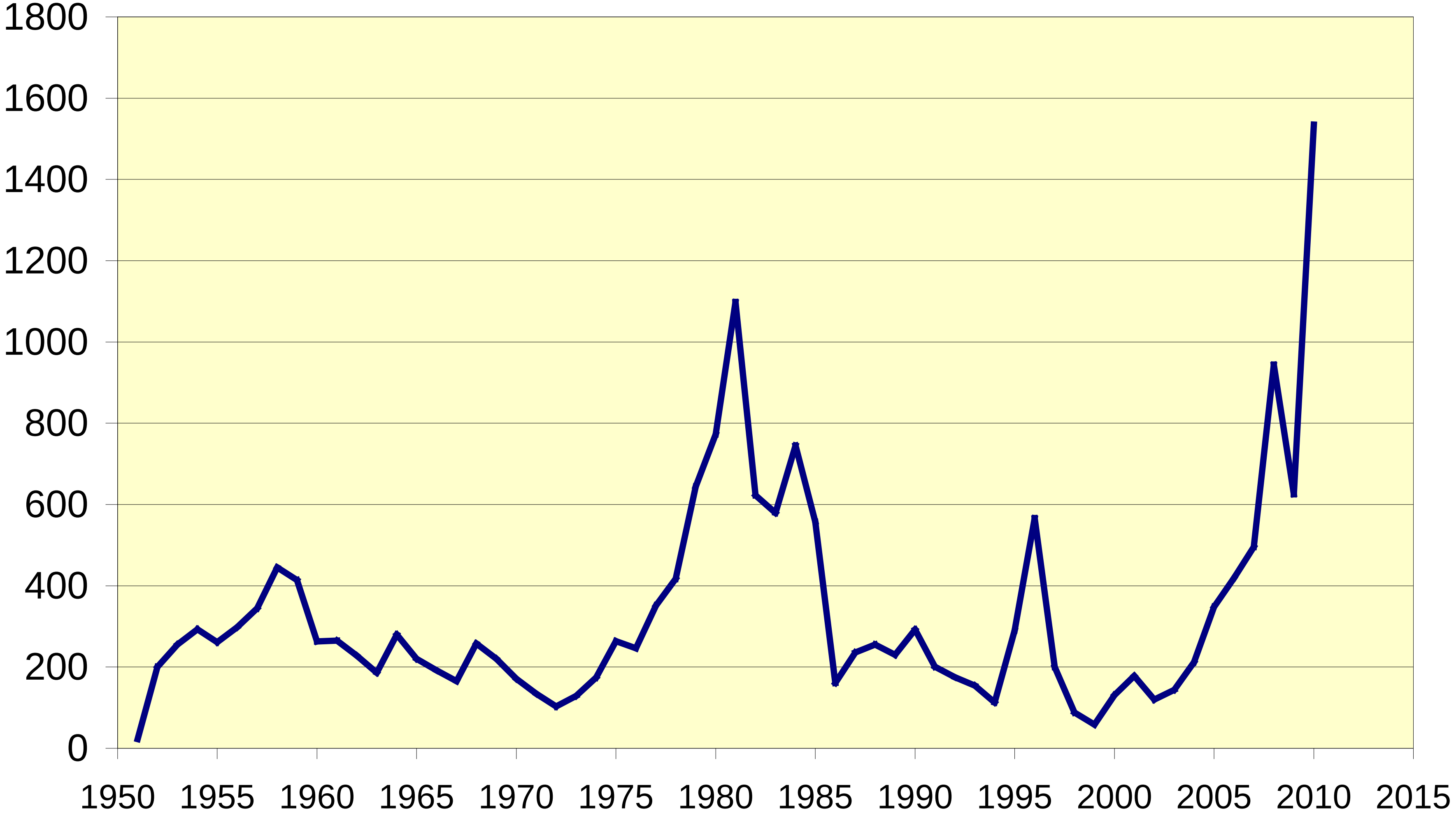
North Dakota Department of Mineral Resources

http://www.oilgas.nd.gov

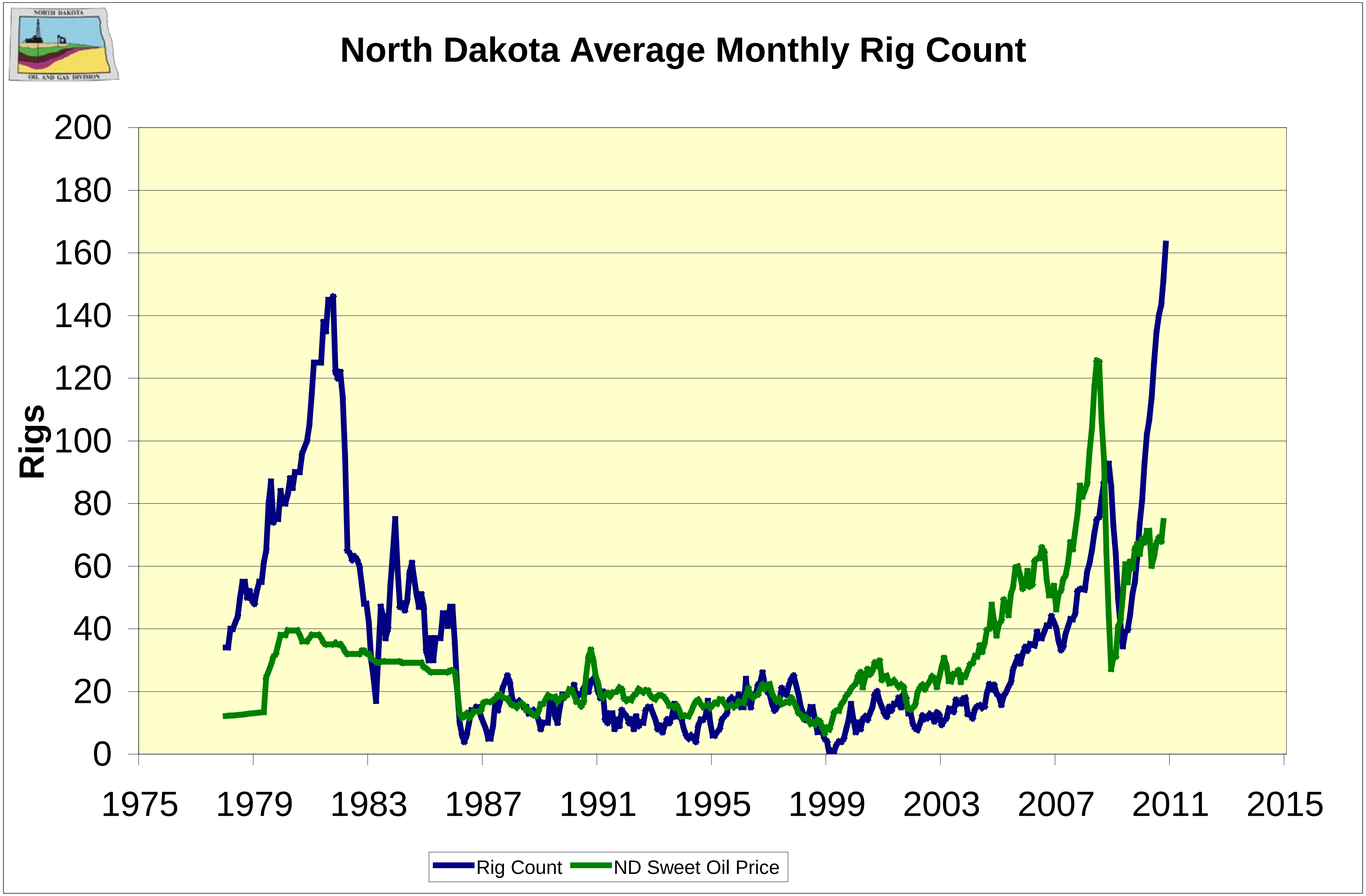
http://www.state.nd.us/ndgs

600 East Boulevard Ave. - Dept 405
Bismarck, ND 58505-0840
(701) 328-8020   (701) 328-8000

North Dakota New Well Permits Issued



North Dakota Average Monthly Rig Count



Oil and Gas : ArcIMS Viewer

Legend / Layers
Overview Map
View Entire State
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Zoom In
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Find Well
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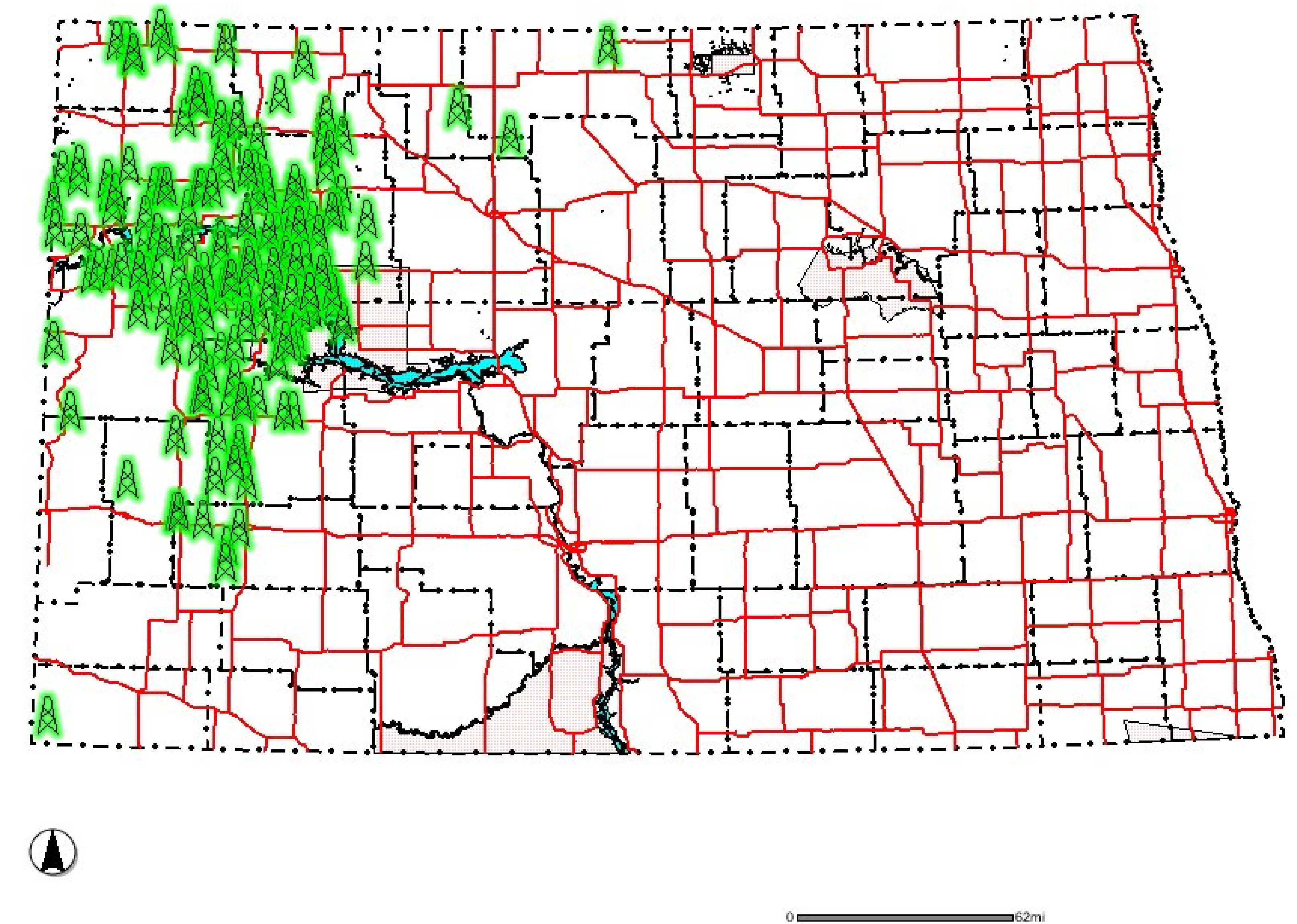
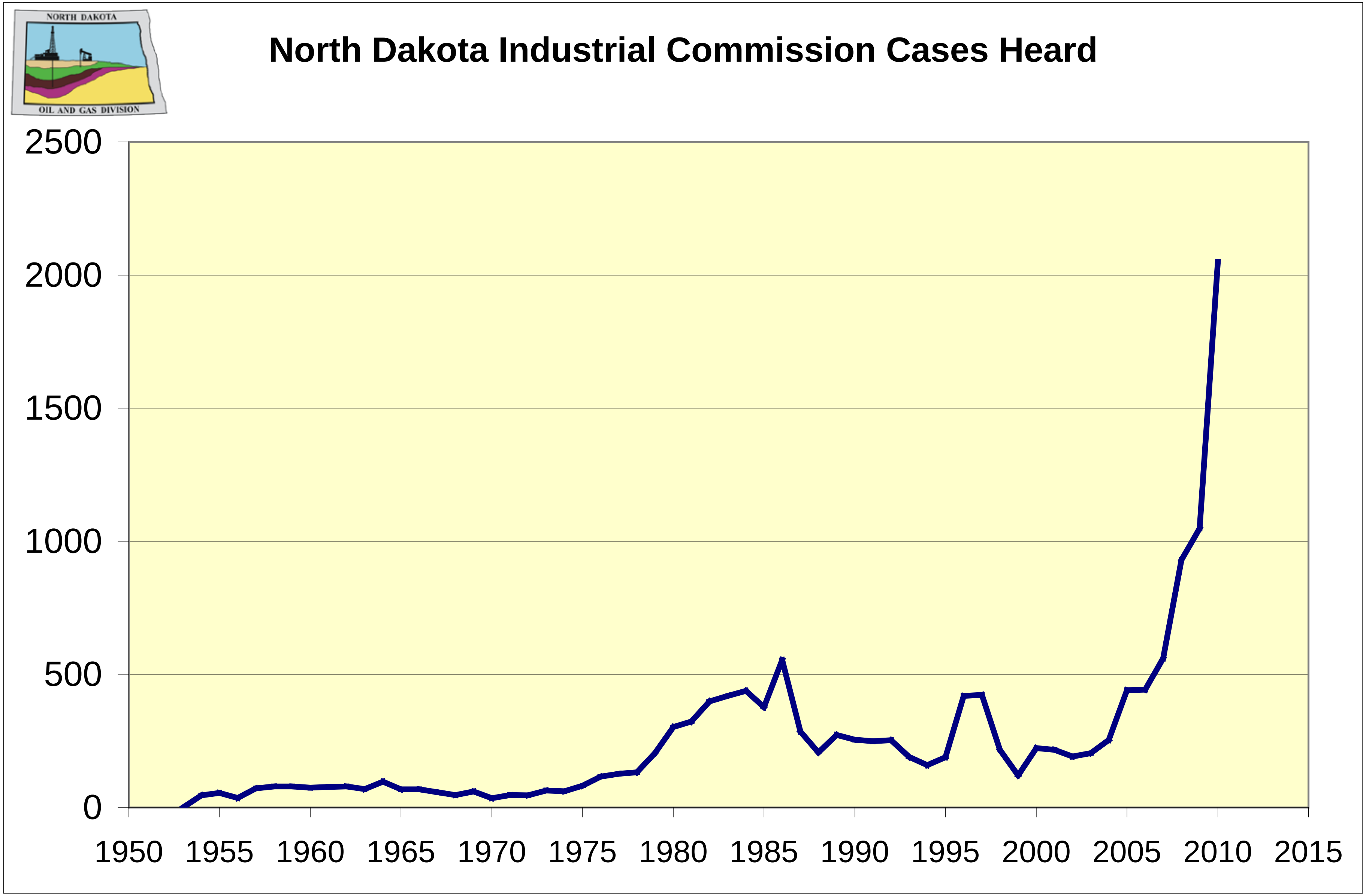
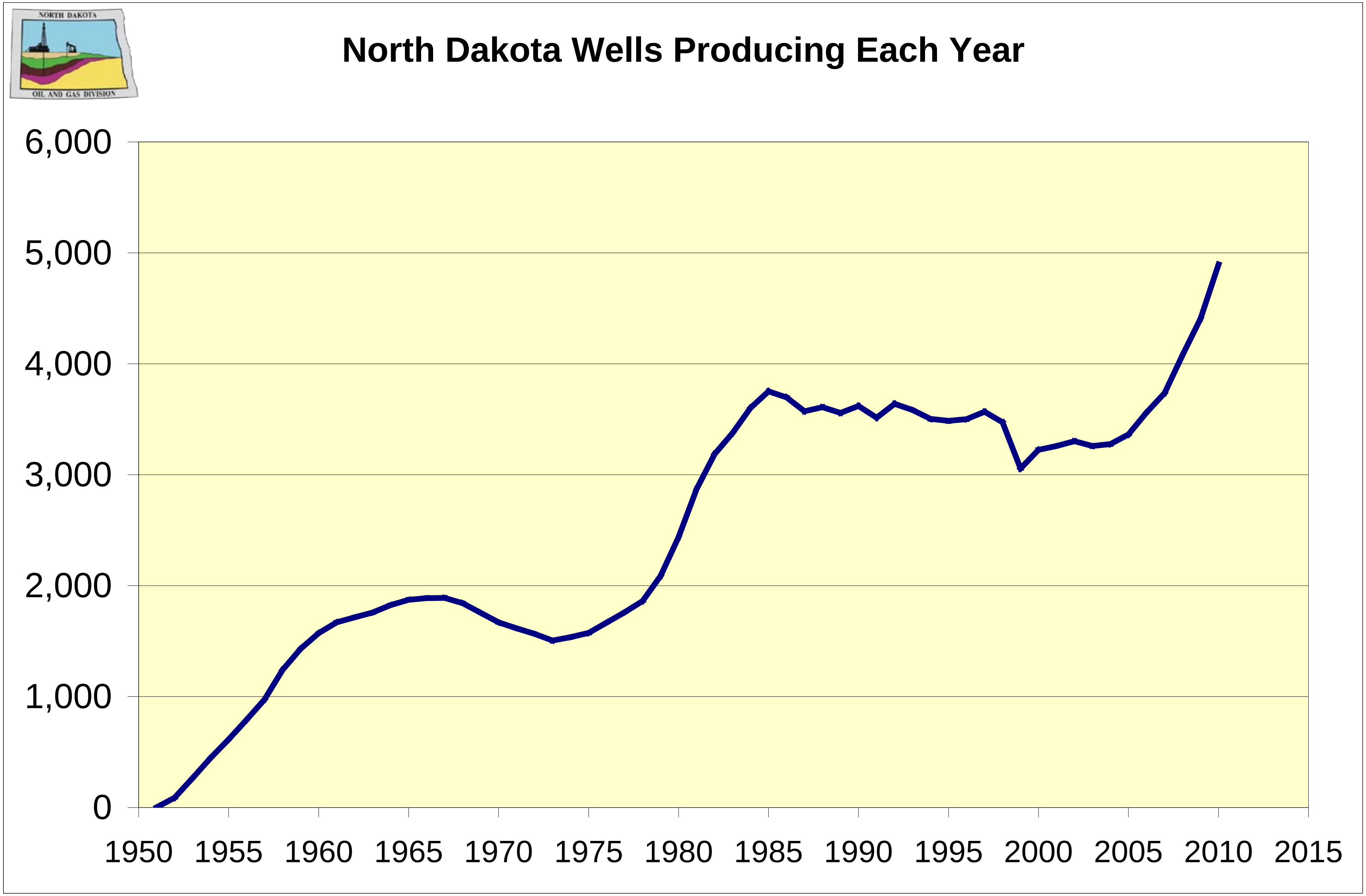
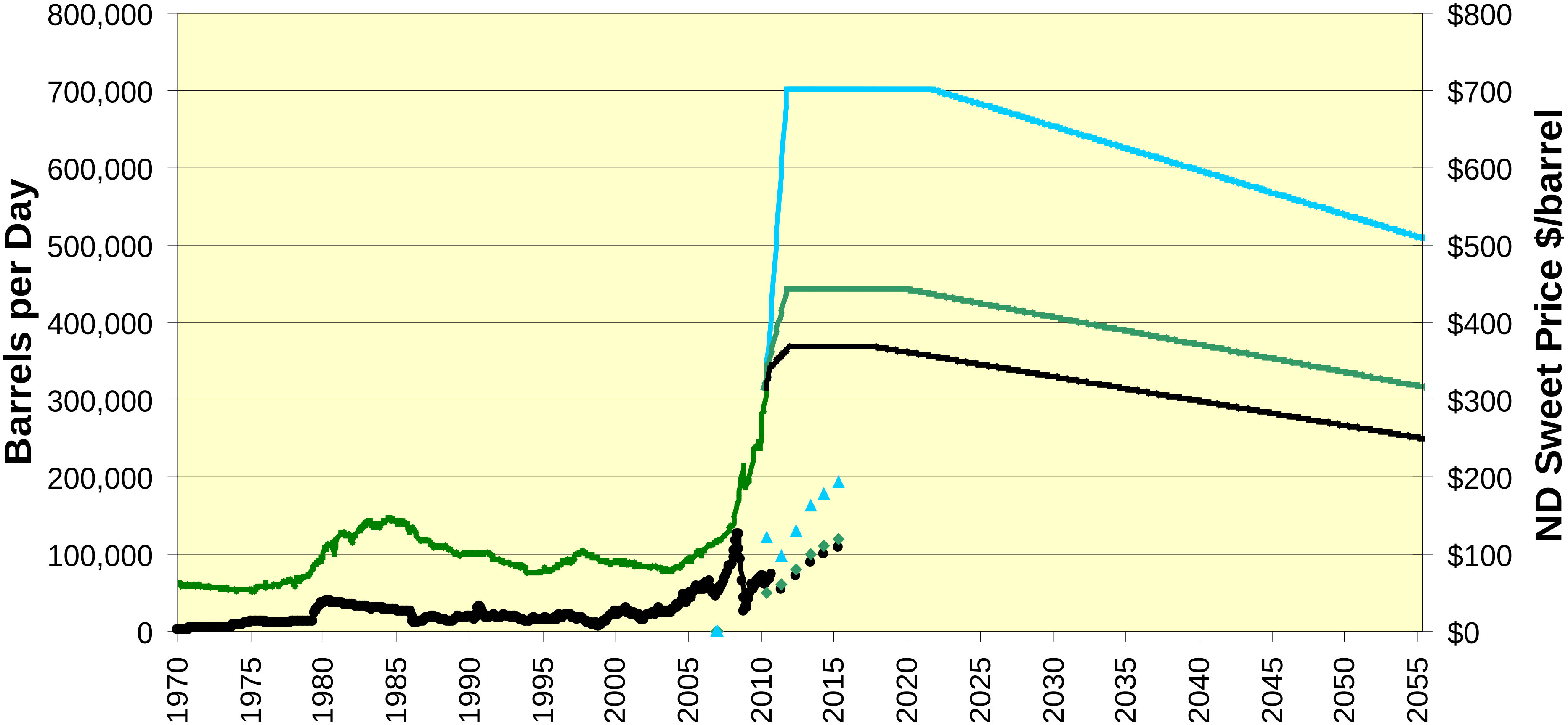
Find Section




NORTH DAKOTA
OIL AND GAS DIVISION
North Dakota Industrial Commission Cases Heard
2500
2000
1500
1000
500
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015


North Dakota Wells Producing Each Year
6,000
5,000
4,000
3,000
2,000
1,000
0
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015

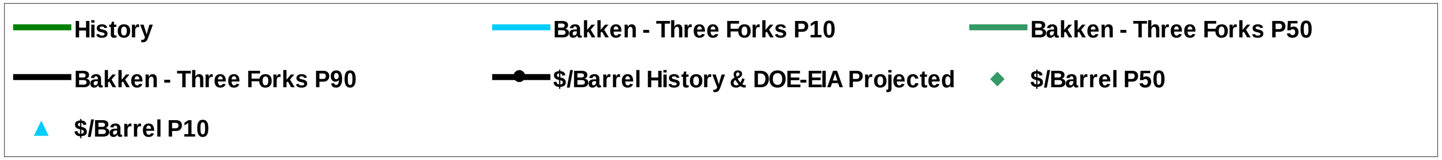
North Dakota Oil Production and Price

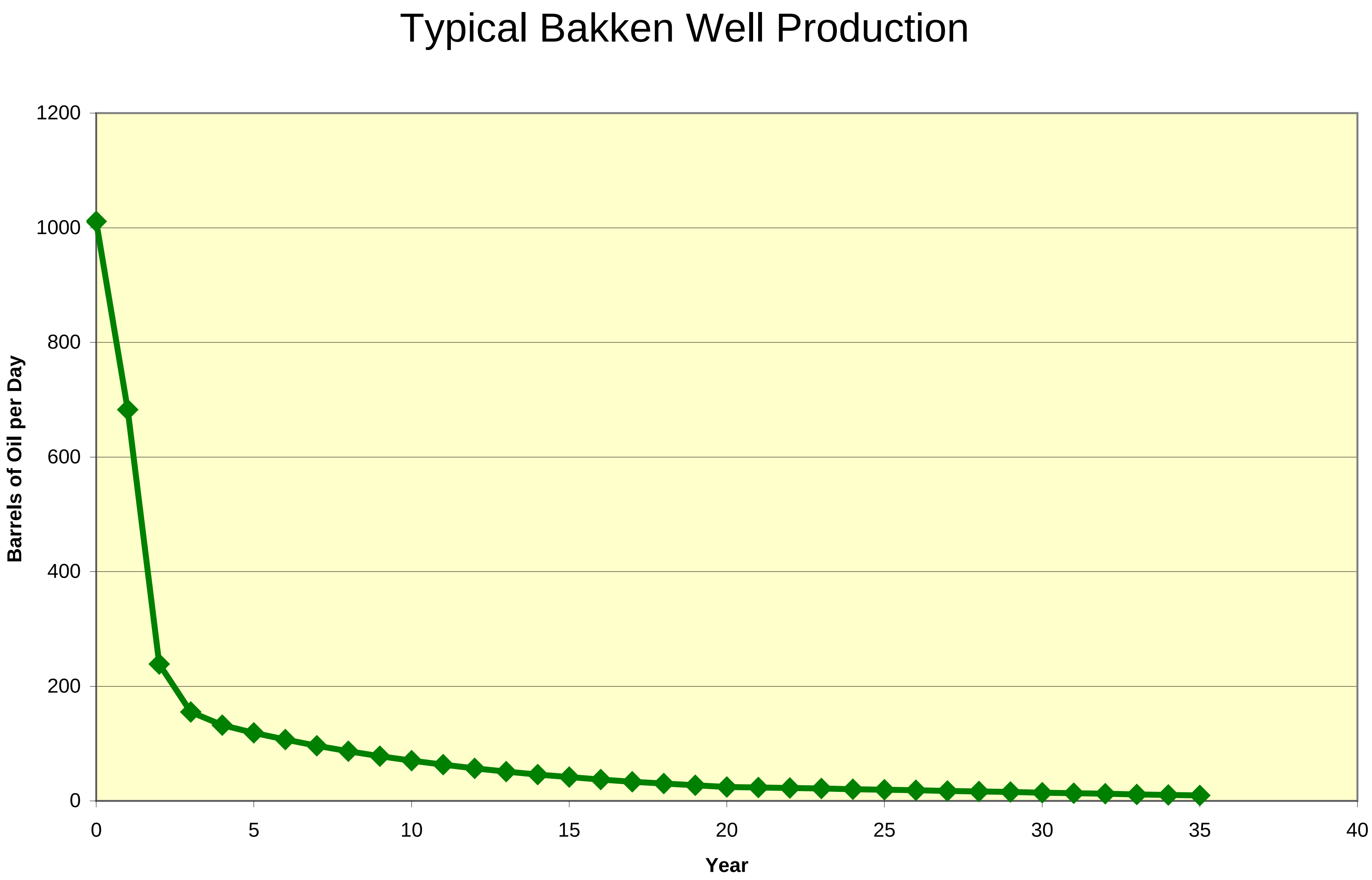


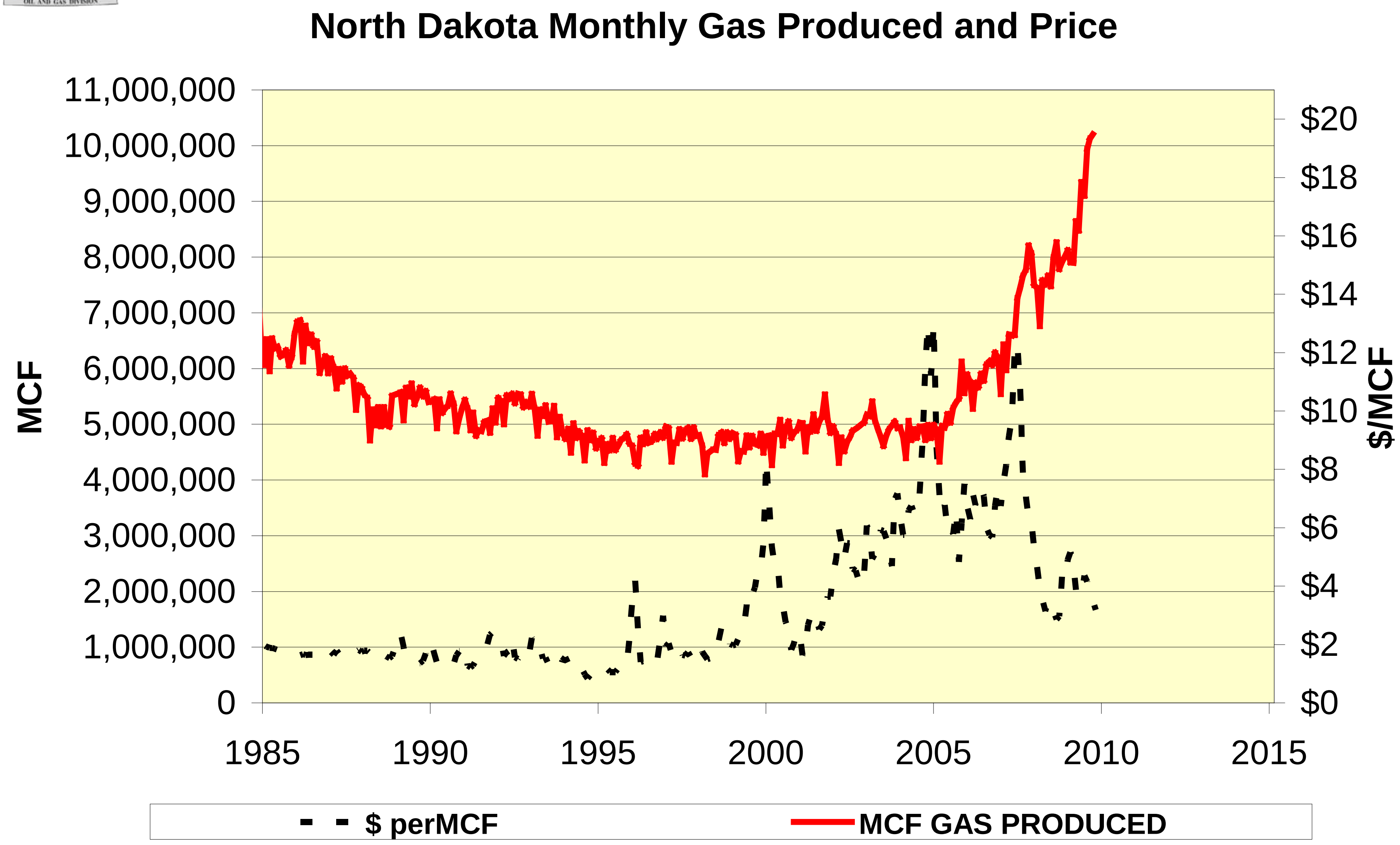
1,750 Bakken and Three Forks wells drilled and completed

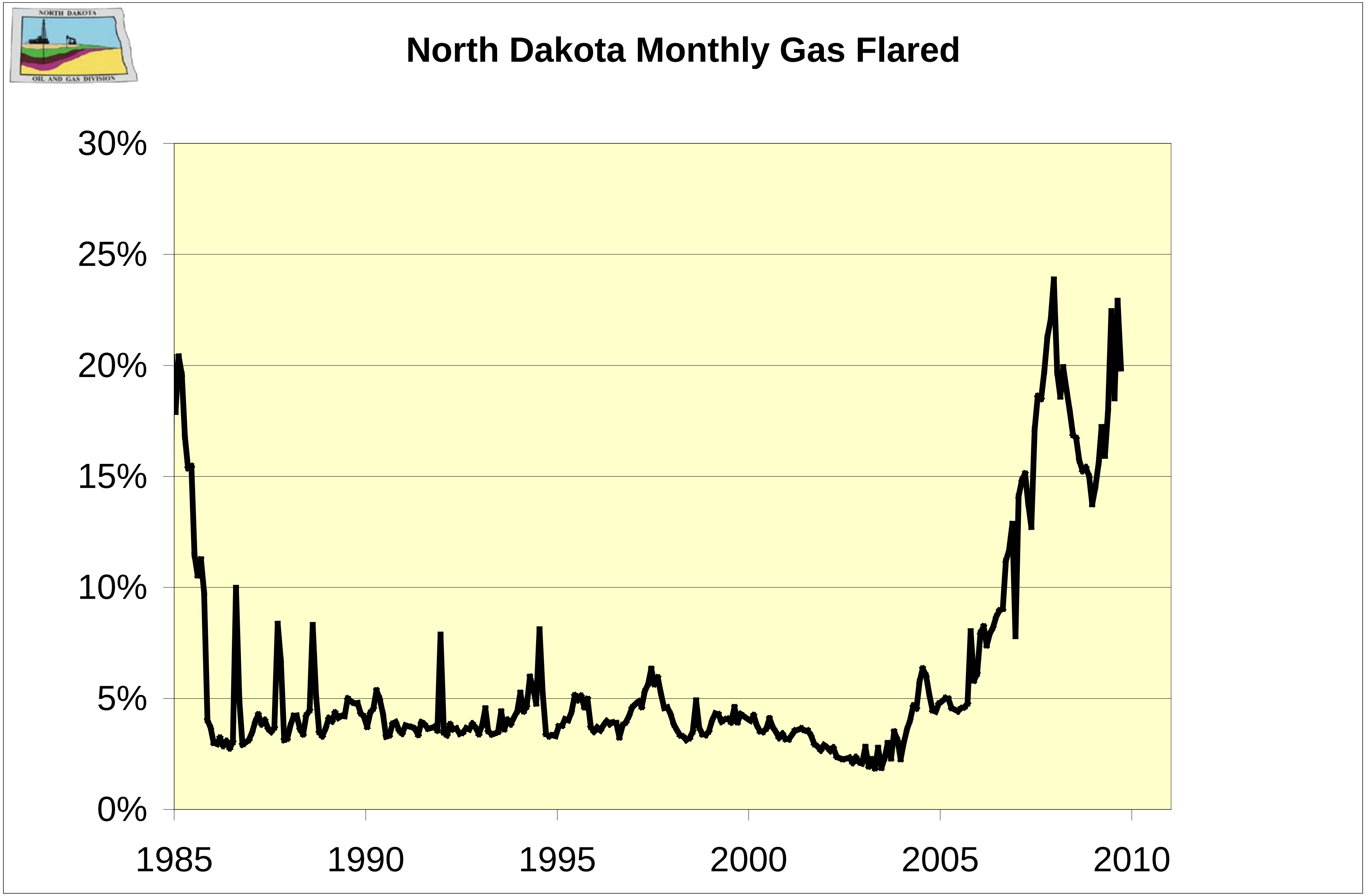
22,000 potential new wells possible in thermal mature area

5 -7 – 11 billion barrels



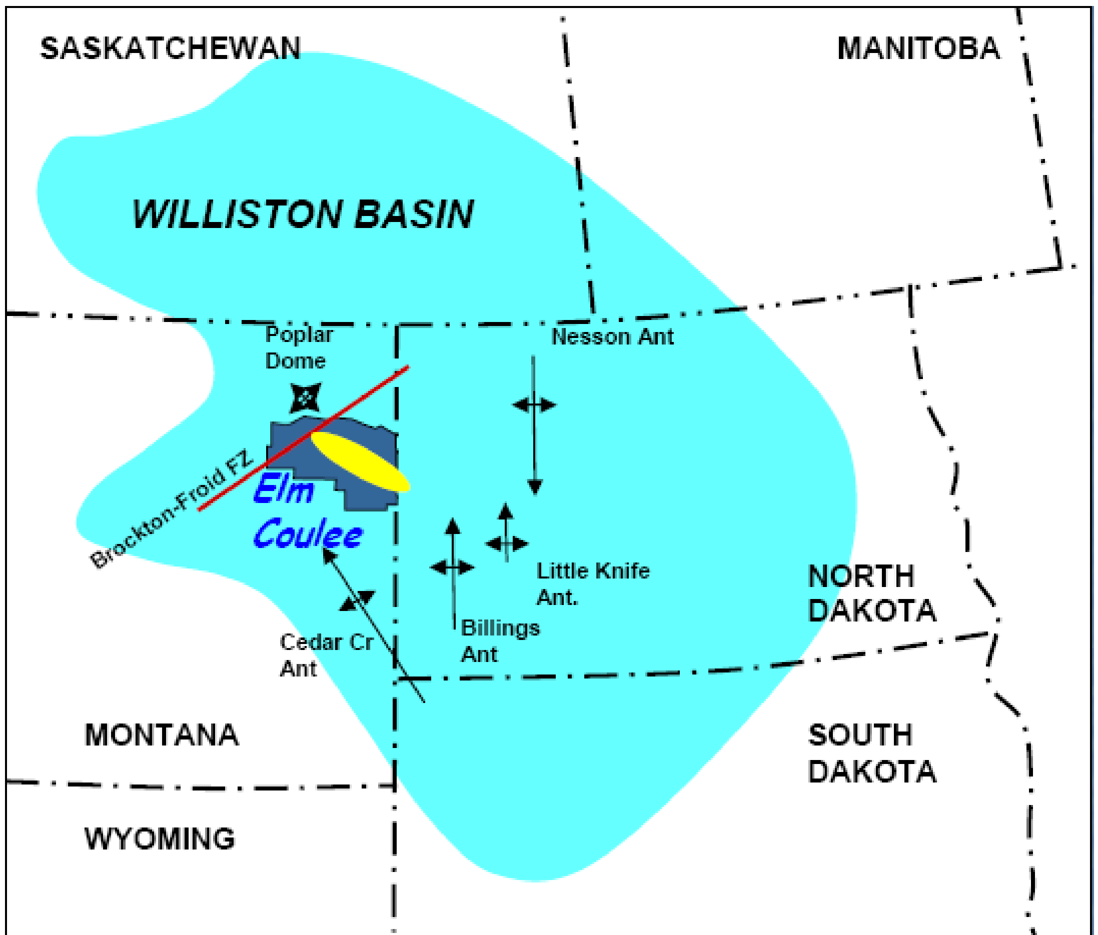

Typical Bakken Well Production
Barrels of Oil per Day
1200
1000
800
600
400
200
0
0
5
10
15
20
25
30
35
40
Year


North Dakota Monthly Gas Produced and Price
MCF
$/MCF
11,000,000
10,000,000
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
$20
$18
$16
$14
$12
$10
$8
$6
$4
$2
$0
1985
1990
1995
2000
2005
2010
2015
$ perMCF
MCF GAS PRODUCED



NORTH DAKOTA
OIL AND GAS DIVISION
North Dakota Monthly Gas Flared
30%
25%
20%
15%
10%
5%
0%
1985
1990
1995
2000
2005
2010

What's New?



SASKATCHEWAN
MANITOBA
WILLISTON BASIN
Poplar Dome
Nesson Ant
Brockton-Froid FZ
Elm Coulee
Little Knife Ant.
NORTH DAKOTA
Billings Ant
Cedar Cr Ant
MONTANA
SOUTH DAKOTA
WYOMING

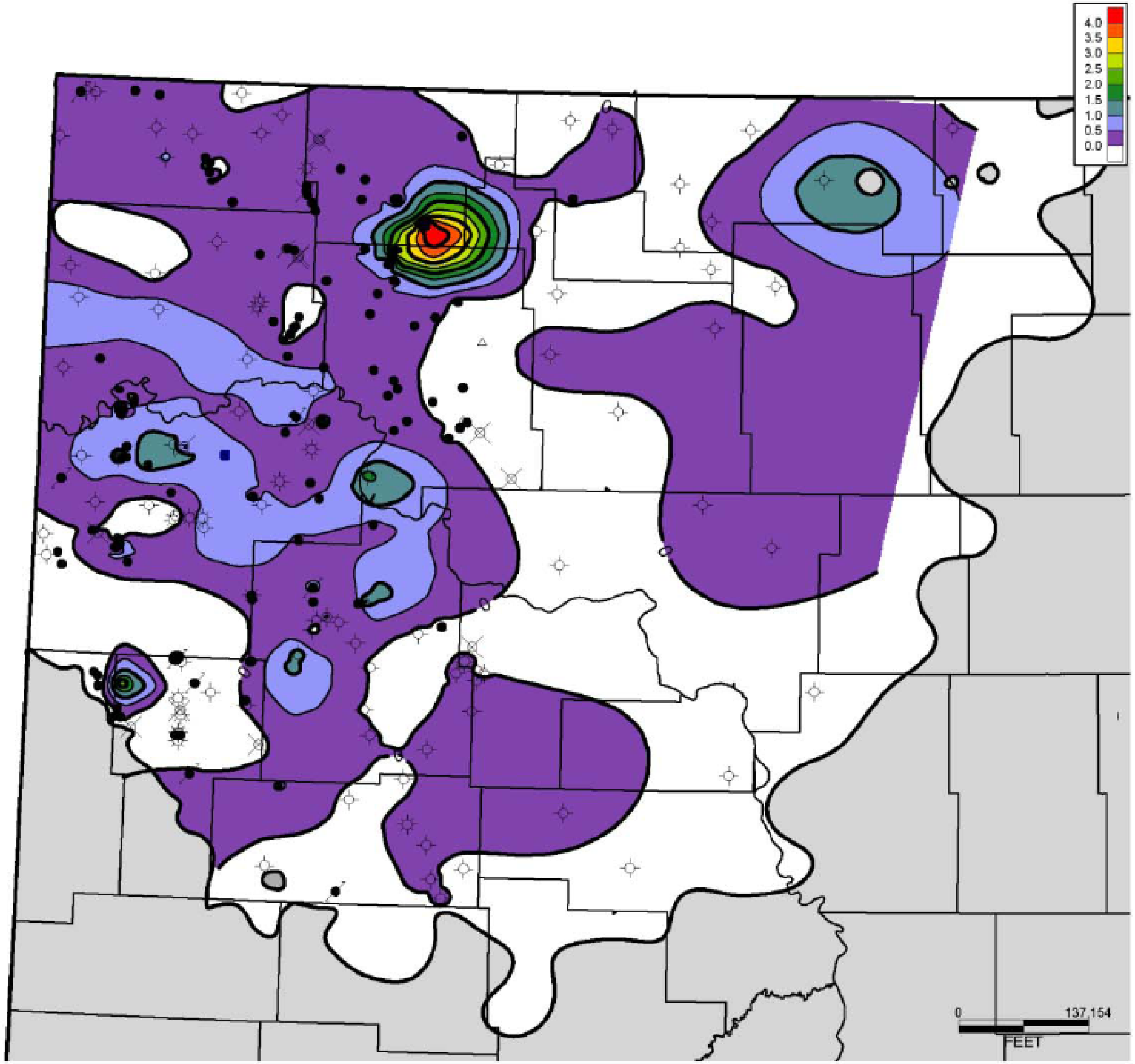


Figure 4) Total original oil in place (OOIP) for the Three Formation contoured as acre-feet oil. Only those intervals containing at least 50% oil-filled porosity contribute to the net pay that is contoured as acre-feet oil. The well locations illustrated correspond to the wells used in this study.

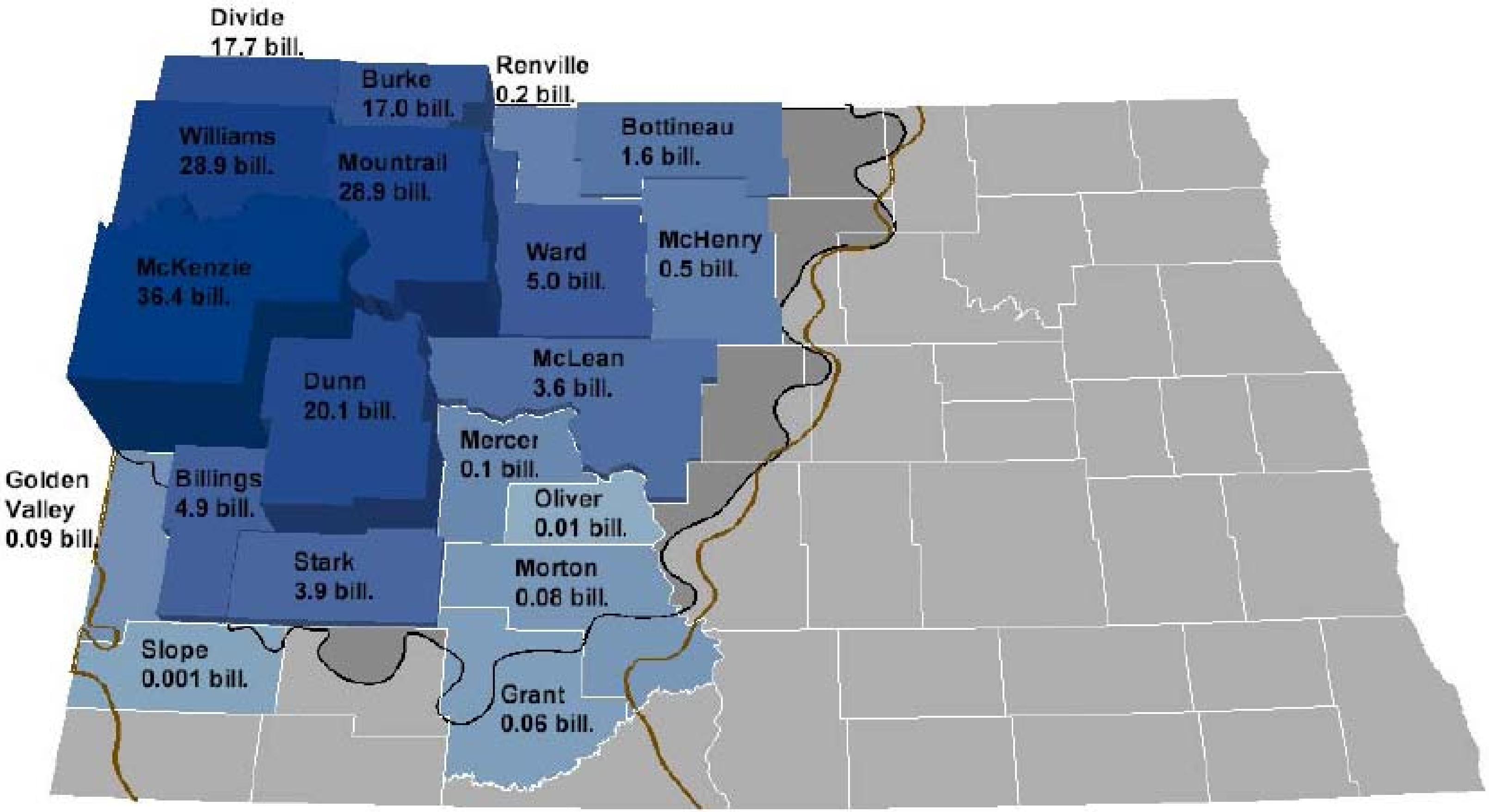


Fig. 7) Combined OOIP for the Three Forks and Bakken by county.

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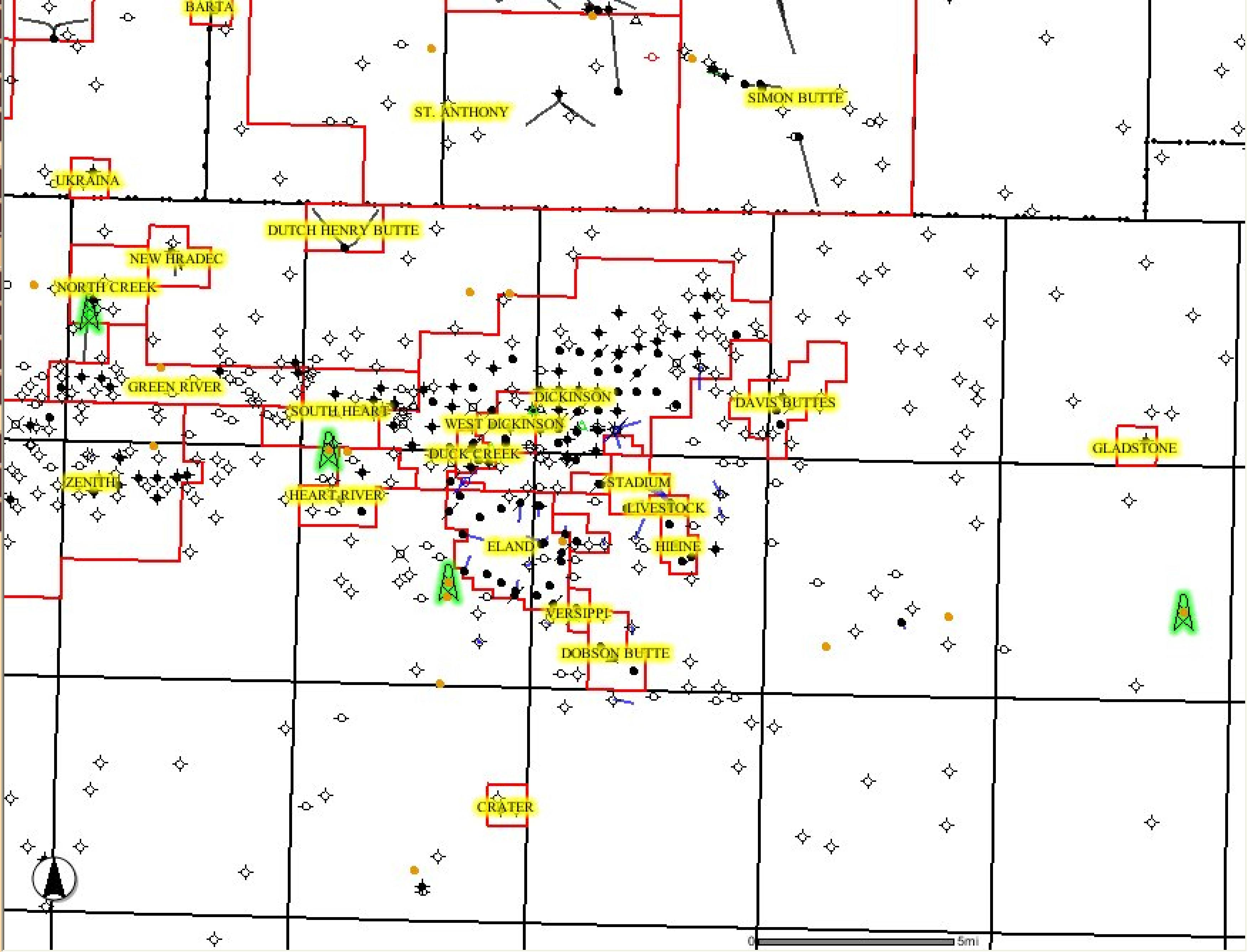
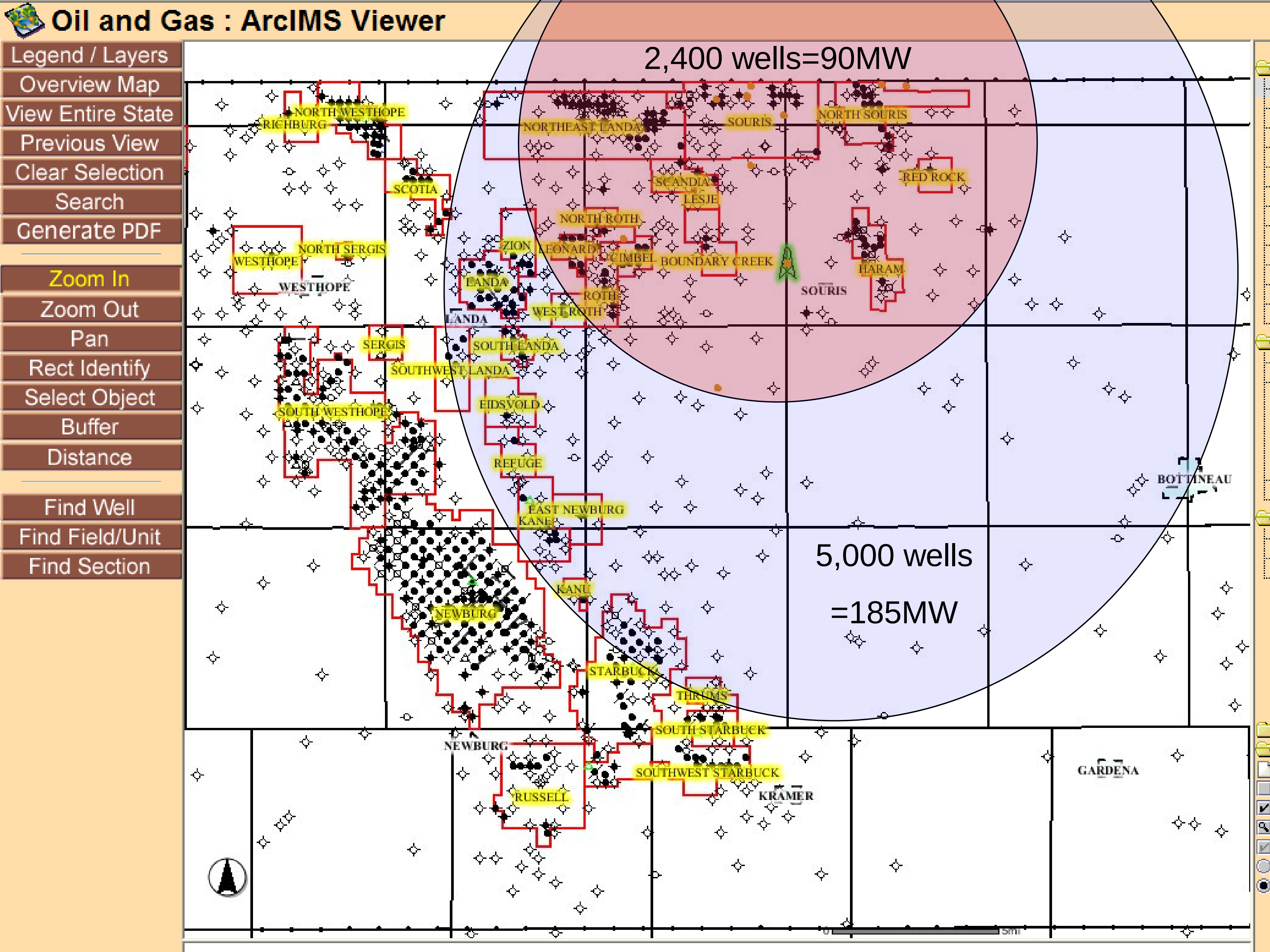




Oil and Gas : ArcIMS Viewer
Legend / Layers
Overview Map
View Entire State
Previous View
Clear Selection
Search
Generate PDF
Zoom In
Zoom Out
Pan
Rect Identify
Select Object
Buffer
Distance
Find Well
Find Field/Unit
Find Section
2,400 wells=90MW
5,000 wells
=185MW
NORTH WESTHOPE
RICHBURG
NORTHEAST LANDA
SOURIS
NORTH SOURIS
SCOTIA
SCANDIA
LESJE
RED ROCK
NORTH ROTH
NORTH SERGIS
WESTHOPE
ZION
LEONARD
CIMBEL
BOUNDARY CREEK
HARAM
LANDA
ROTH
WEST ROTH
SOURIS
SERGIS
SOUTH LANDA
SOUTHWEST LANDA
SOUTH WESTHOPE
EIDSVOLD
REFUGE
EAST NEWBURG
KANE
BOTTINEAU
KANU
NEWBURG
STARBUCK
THRUMS
SOUTH STARBUCK
SOUTHWEST STARBUCK
RUSSELL
KRAMER
GARDENA

North Dakota Geological Survey
Geologic Investigations No. 127

Edward C. Murphy, State Geologist
Lynn D. Helms, Director Dept. of Mineral Resources
2010

RESOURCE POTENTIAL OF THE TYLER FORMATION

Stephan H. Nordeng and Timothy O. Nesheim

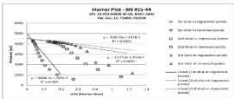


Figure 1. Horner plot of pressures measured during the shut-in periods of an open hole drill stem test (DST) of the Tyler Formation (8180-8282 ft. M.D.) in Pennzoil Co. & Depco's BN#15-44 (Figure 5, #6848). The extrapolated shut in pressures (Horner, 1951) from the 2nd and 3rd shut in periods of the DST indicate that the Tyler formation fluid pressure is ~4525 psi at a depth of 8230 ft., which yields a pressure gradient (0.55 psi/ft.) above the expected hydrostatic pressure range (0.43-0.46 psi/ft.). The 1st shut-in period did not reach "steady-state" conditions and therefore does not yield a reliable extrapolated formation pressure. The fluid recovered in this test was 354' of gas cut mud. This well was spudded on February 2nd, 1979 (DST run on March 18th, 1979) in the Flat Top Butte field, where only one well produced just 446 bbls of oil from the Tyler-Heath Formation over a four month period in 1960 (Texaco Inc.'s Mary Pace #1; API: 33-053-00461-00-00; NDIC: 2667; Sec. 14, T146W, R101W). There is no record of injection within the Flat Top Butte field.

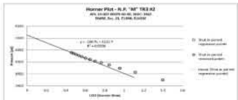


Figure 2. Horner plot of pressures measured during the shut-in period of an open hole drill stem test (DST) of the Tyler Formation (7743-7776 ft. M.D.) in Amerada Petroleum Corp.'s N.P. "M" TR# 2, shown on Figure 5 by #3867. Both the maximum pressure recorded (4039 psi = 0.52 psi/ft.) and the extrapolated formation pressure (4112.7 psi = 0.53 psi/ft.) are above the hydrostatic pressure range expected for the depth tested (3300-3560 psi = 0.43-0.46 psi/ft.). The DST fluid recovery was 2.5 BBLS oil, reversed out 69.54 BBLS oil. Cumulative production for this well was 1,440,113 BBLS of oil. This well was spudded on May 2nd, 1965 (DST run on May 15th, 1965) in the Medora field, where initial production began in June, 1964 and initial injection in February, 1970.

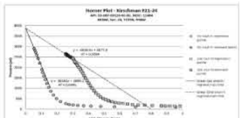


Figure 3. Horner plot of pressures measured during the shut in periods of a conventional bottom hole drill stem test (DST) on the Tyler Formation (7540-7556 ft. M.D.) in Milestone Petroleum's Kirschman #21-24, shown on Figure 5 by #11484. The calculated fluid pressure of the Tyler formation (the average of the extrapolated pressures from the two DST shut in periods) is ~3883 psi at a depth of 7545 ft., which yields a pressure gradient (0.51 psi/ft.) above the hydrostatic pressure expected for this depth (0.43-0.46 psi/ft.). The DST fluid recovered was 0.03 bbls of oil and 0.48 bbls of water. Kirschman #21-24 was a wildcat well drilled outside areas of production and injection for the Tyler Formation.

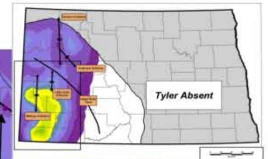


Figure 6. Time-Temperature Index map of the Pennsylvanian Tyler Formation in the Williston Basin of North Dakota. The color-filled contours represent the Time Temperature Index of the Tyler Formation. Areas in which the Tyler is absent are in gray (modified from Anderson, 1974).

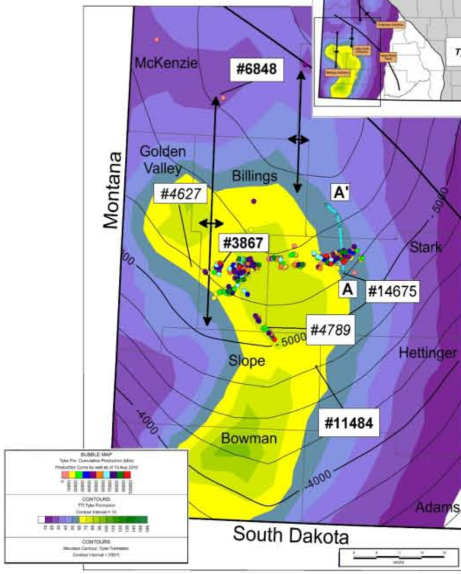


Figure 5. Detail map showing the distribution of Tyler production (Total Bbls) in North Dakota together with Time-Temperature contours and the location of wells from which pressure gradients (#6848, #3867, #11484) and Rock Eval data (#4627, #4789) were obtained. The color-filled contours represent the Time-Temperature Index of the Tyler Formation and are keyed to the color bar located in the lower left corner. Shades of yellow and green (>65) represent the TTIs that correspond with the oil window. TTIs less than 65 and above 15 are in shades of blue and purple and represent conditions that could generate oil. This map lies within the black outline on Figure 6. Cumulative production from the Tyler Formation (barrels oil) is represented by the color of the circles centered on the wells that have and/or are producing oil from the Tyler Formation. The solid contour lines on the detail map represent the mean sea level elevation of the top of the Tyler Formation.

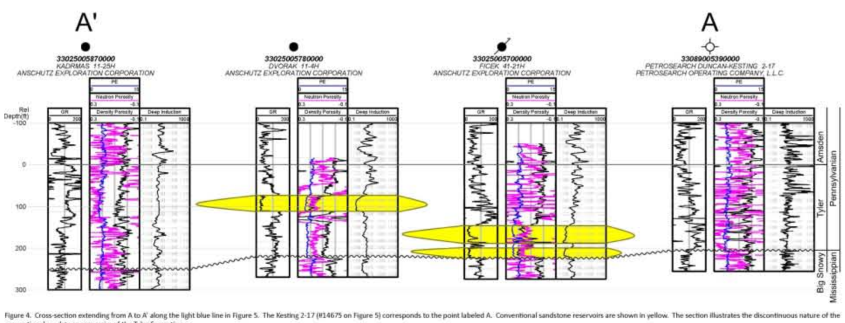


Figure 4. Cross-section extending from A to A' along the light blue line in Figure 5. The Kesting 2-17 (#14675 on Figure 5) corresponds to the point labeled A. Conventional sandstone reservoirs are shown in yellow. The section illustrates the discontinuous nature of the conventional sandstone reservoirs of the Tyler Formation.

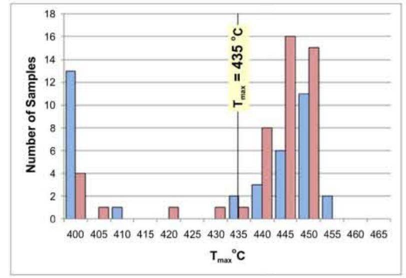


Figure 7. A frequency diagram showing that most of the samples of the Tyler Formation collected from the Government Taylor A-1 (#4627) in red, and the State of North Dakota #41-36 (#4789) in blue, have been thermally matured beyond the threshold that marks the onset of oil generation (Tmax ~435oC).

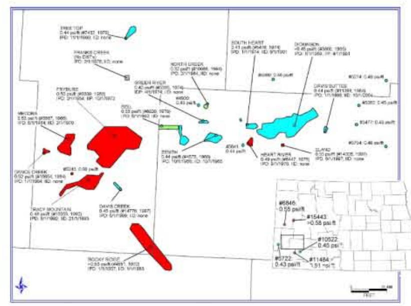


Figure 8. Field map showing the producing Tyler Fields in southern Billings, Slope, and Stark counties. For each field the Initial Pressure Gradient (IPG), Initial Production Date (IPD), and Initial Injection Date (IID) are given. Fields with evidence of initial fluid overpressure in the Tyler are colored in red, fields that were initially at hydrostatic pressure are colored in blue, and fields that were underpressured prior to production are colored green. Most of the western Tyler fields all contain evidence of overpressuring prior to injection with the exception of Davis Creek. The eastern Tyler fields were at or below hydrostatic pressure, with the exception of the Heart River and Eland fields. Field boundaries are approximate. In the bottom right corner is an index map of North Dakota showing the Tyler DST's of interest with their NDIC well numbers that are located outside the main area of Tyler production. DST results indicate that the Tyler Formation is over-pressured in three wells and at hydrostatic pressure within two wells outside the area of main production.

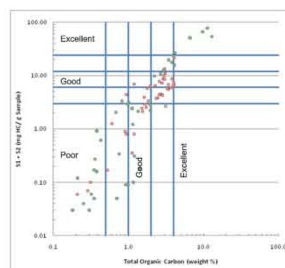


Figure 9. A kerogen quality diagram (Dembicki, 2009) constructed from the Total Organic Carbon (TOC) versus the mass of existing (S1) and potential (S2) hydrocarbons contained in samples of the Tyler Formation. The samples are from the Government Taylor A-1 (green circles) and the State of North Dakota #41-36 (red squares).

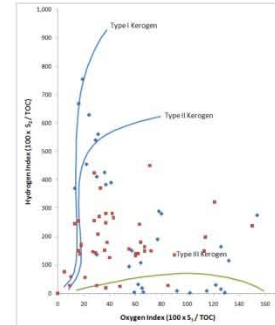


Figure 10. A modified van Krevelen diagram that classifies kerogen on the basis of the Hydrogen Index (HI) and Oxygen index (OI) derived from Rock Eval pyrolysis data. The blue diamonds represent the data from the Government Taylor A-1 (NDIC # 4627, SESE, Sec. 9, T139N, R103W) and the red squares refer to data from the State of North Dakota #41-36 (NDIC #: 4789, NE NE, Sec. 36, T137N, R100W). The data suggest that kerogen within the Tyler Formation includes oil prone Type I and Type II, gas prone Type III as well as mixtures of both oil and gas prone kerogen.

Discussion

The purpose of this study is to examine the pressures within the Pennsylvanian aged Tyler Formation with the intent of determining whether or not the formation exhibits pressure-depth relationships consistent with a source system that is hydraulically isolated from the over and underlying formations. Hydraulic isolation is one of the key elements that Schmoker (1996) used to define a basin-centered petroleum accumulation. Meissner (1978) recognized several of these elements in the Bakken Formation in the Williston basin. In these accumulations, the source rock and reservoir rock are either one and the same or lie in very close proximity to one another. This occurs because the rocks that encase the source beds lack sufficient permeability to allow petroleum generated within the source beds to escape and migrate away. As a result, pressures within the source beds and associated reservoir rocks typically exhibit abnormally high or low formation fluid pressures relative to the pressure expected in a reservoir that is in hydraulic communication with the overlying rocks. The "expected" pressure in this study assumes hydrostatic conditions so that the expected pressure would be consistent with a hydrostatic gradient of between 0.43 and 0.49 psi/ft. Therefore, abnormally low or high pressure would yield hydraulic gradients (pressure/depth) that lie outside the range of gradients that correspond with fresh water (0.43 psi/ft) or saltwater (0.49 psi/ft).

The Tyler Formation is a regionally extensive, organically-rich, Pennsylvanian unit deposited during the earliest stages of the Absaroka Sequence. Terrestrial sediments derived from source areas south of the Williston basin are interbedded with nearshore, marine limestone and shale (Gerhard and Anderson, 1988). The Tyler Formation is bounded below by an erosional surface developed on Mississippian aged rocks formed during tectonic uplift in the Late Mississippian and Early Pennsylvanian. A variety of lithologies consistent with progradation of sediments into the basin overly the Tyler except along the eastern margin of the basin where these rocks have been truncated by the erosional surface that marks the Absaroka – Zuni sequence boundary (Anderson, 1972; Gerhard and Anderson, 1988).

Pressure gradients were obtained from pressure build up curves and pressure recorder depths used during drill stem tests of the Tyler Formation. Estimates of formation pressures are obtained by constructing Horner plots in which formation pressures are plotted against the logarithm of Horner time (Horner Time = [total Flow Time + ΔShut-in time]/ΔShut-in time). The formation pressure is determined from the Horner plot by finding the y-intercept of the best-fit line that passes through the pressures recorded during the last part of the shut-in periods (See Figures 1-3).

The range of initial pressure gradients present in the Tyler Formation suggest that the formation is frequently over-pressured and in a few cases under-pressured. Several fields were initially over-pressured and prior to injection: Dance Creek, Eland, Flat Top Butte, Fryburg, Heart River, Medora, Rocky Ridge, and Round Top Butte (Figure 8). Most of these over-pressured fields are located on the western side of the producing Tyler fields. Two fields may have been under-pressured prior to production, Bell and North Creek, which are located in the central area of most of the producing Tyler Fields (Figure 8). These results lead to the conclusion that the Tyler Formation is not always in hydraulic communication with the units above or below it and thus suggests that the Tyler may be sufficiently isolated so as prevent the petroleum generated within the Tyler Formation to escape.

The Time-Temperature Index (TTI) map of the Tyler Formation, constructed from modern geothermal heat flow measurements (SMU Geothermal Lab, 2010) and stratigraphic interval thickness data shows that oil production from the Tyler Formation is from rocks that are mature enough to generate oil. RockEval data also indicates that at least some of the organic-rich rocks within the Tyler are good to excellent source rocks even though there is probably more than one type of kerogen present. The available Rock Eval data also confirms the presence of thermally mature shales in vicinity of current Tyler production (Figures 5 & 7).

The limited data available today suggest the Tyler Formation is a regionally extensive unit that may contain good to excellent quantities of oil prone kerogen (Figures 9 & 10) that is sufficiently mature (Figure 7) to generate oil within a hydraulically compartmentalized environment (Figure 8). If so, then the Tyler Formation possesses the elements needed to qualify as a basin centered petroleum accumulation.

References

Anderson, S. B., 1974, Pre-Mesozoic paleogeographic map of North Dakota, North Dakota Geological Survey, Misc. Map 17, 1 Plate.

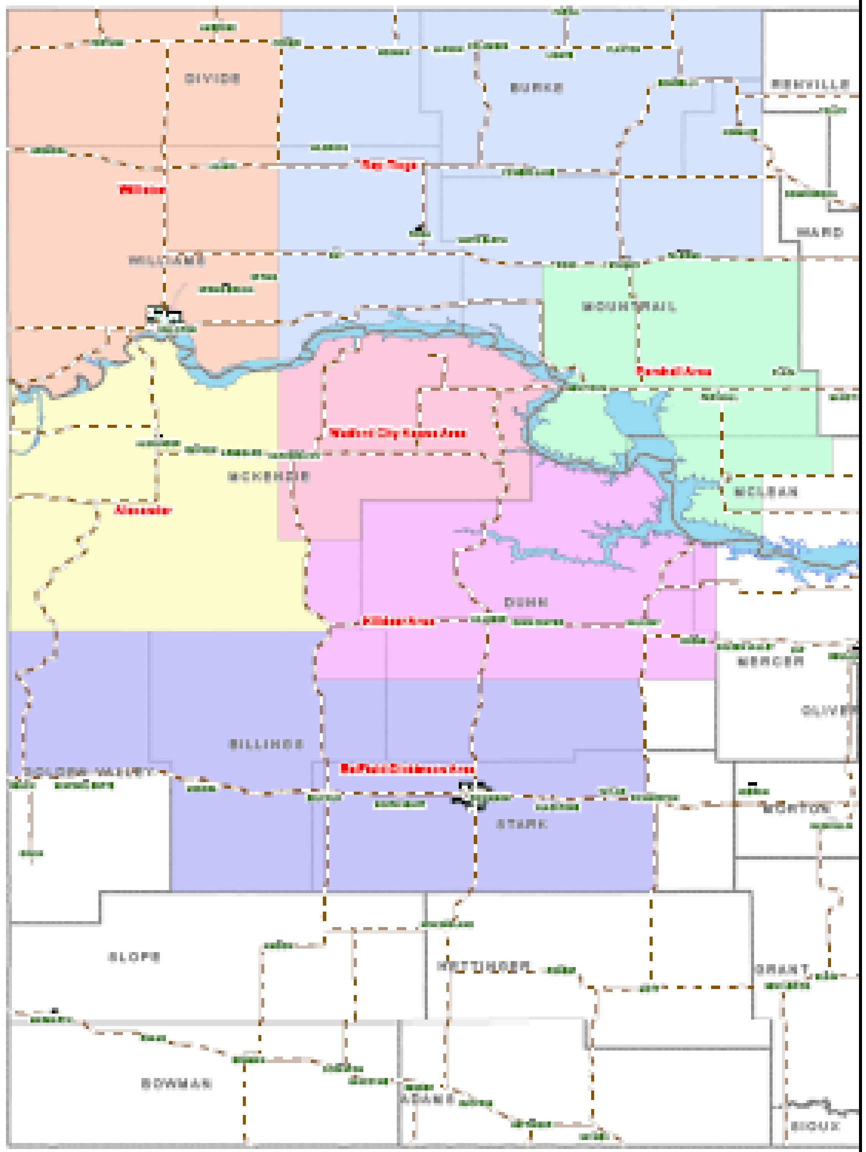
Dembicki, H., 2009, Three common source rock evaluation errors made by geologists during prospect or play appraisals, American Association of Petroleum Geologists Bulletin, v. 93, p 341-356

Gerhard, L. C., Anderson, S. B., 1988, Geology of the Williston Basin (United States portion), Sedimentary Cover-North American Craton: U.S., L. L. Sloss (ed). Geological Society of America, Boulder Colorado, Pg. 221-223.

Horner, D.R., 1951, Pressure build-up in wells: Proceedings of Third World Petroleum Congress, Section II, pp. 503-521.

Meissner, F.F., 1978, Petroleum geology of the Bakken Formation Williston Basin, North Dakota and Montana, in D. Rehig, ed., 1978 Williston Basin Symposium: Montana Geological Society, Billings, Montana, p. 207-227.

Schmoker, J.W., 1996, Method for assessing continuous-type (unconventional) hydrocarbon accumulations, in Gautier, D.L., Dolton, G.L., Takahashi, K.I., and Varnes, K.L., eds., 1995 National assessment of United States oil and gas resources—Results, methodology, and supporting data: U.S. Geological Survey Digital Data Series 30, release 2, 1 CD-ROM.


DIVIDE
BURKE
RENVILLE
WARD
WILLIAMS
MOUNTRAIL
MCKENZIE
MCLEAN
DUNN
MERCER
OLIVER
BILLINGS
GOLDEN VALLEY
STARK
MORTON
SLOPE
HETTINGER
GRANT
BOWMAN
ADAMS
SIOUX

Western North Dakota

- 1,450 to 2,940 wells/year–2,140 expected
    - 100-165 rigs = 12,000 – 19,800 jobs
- 11 - 23 million gallons frac water/day
- 10 to 20 years
    - 21,250 new wells = long term jobs

Williston Area

- 150 to 440 wells per year – 250 expected
  - 15-35 rigs = 1,800 – 4,200 jobs
- 2 million – 5 million gallons frac water/day
- 10 to 20 years
  - 3,750 new wells = long term jobs

Alexander Area

- 150 to 250 wells per year – 180 expected
    - 10-14 rigs = 1,200 – 1,700 jobs
- 2 million – 3 million gallons frac water/day
- 10 to 15 years
    - 2,250 new wells = long term jobs

Ray-Tioga Area

- 300 to 600 wells per year – 400 expected
    - 20-40 rigs = 2,800 – 4,800 jobs
- 3 million – 6 million gallons frac water/day
- 10 to 20 years
    - 6,000 new wells = long term jobs

Watford City - Keene Area

- 250 to 450 wells per year – 350 expected
    - 15-25 rigs = 1,800 – 3,000 jobs
- 3 million – 4 million gallons frac water/day
- 5 to 7 years
    - 2,100 new wells = long term jobs

Killdeer Area

- 250 to 550 wells per year – 400 expected
    - 15-30 rigs = 1,800 – 3,600 jobs
- 3 million – 4 million gallons frac water/day
- 5 to 7 years
    - 2,400 new wells = long term jobs

Parshall Area

- 300 to 550 wells per year – 500 expected
    - 20-40 rigs = 2,400 – 4,800 jobs
- 1.5 – 2.5 million gallons frac water/day
- 7 to 10 years
    - 4,250 new wells = long term jobs

Belfield-Dickinson Area

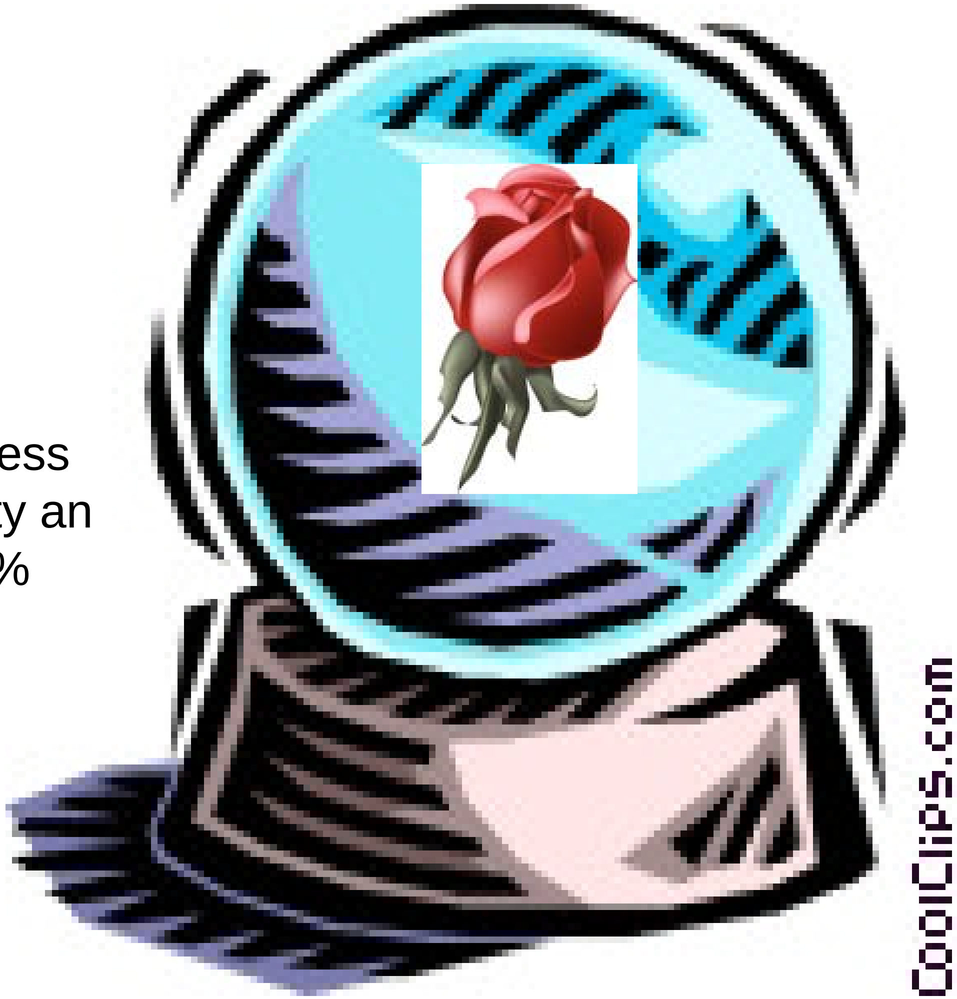
- 50 to 100 wells per year – 60 expected
  - 3-5 rigs = 350 – 600 jobs

- 0.5 – 1 million gallons frac water/day

- 7 to 10 years
  - 500 new wells = long term jobs

Cap and trade proposals in congress would reduce activity an estimated 35-40%

Current administration's budget contains tax changes that would reduce activity an estimated 35-50%



The future looks very rosy for sustainable Bakken/Three Forks development

Federal regulation of hydraulic fracturing would halt activity for 18-24 months

Federal review of drilling regulations would halt activity for 12-18 months

Northern Rockies Oil and Gas Roundup

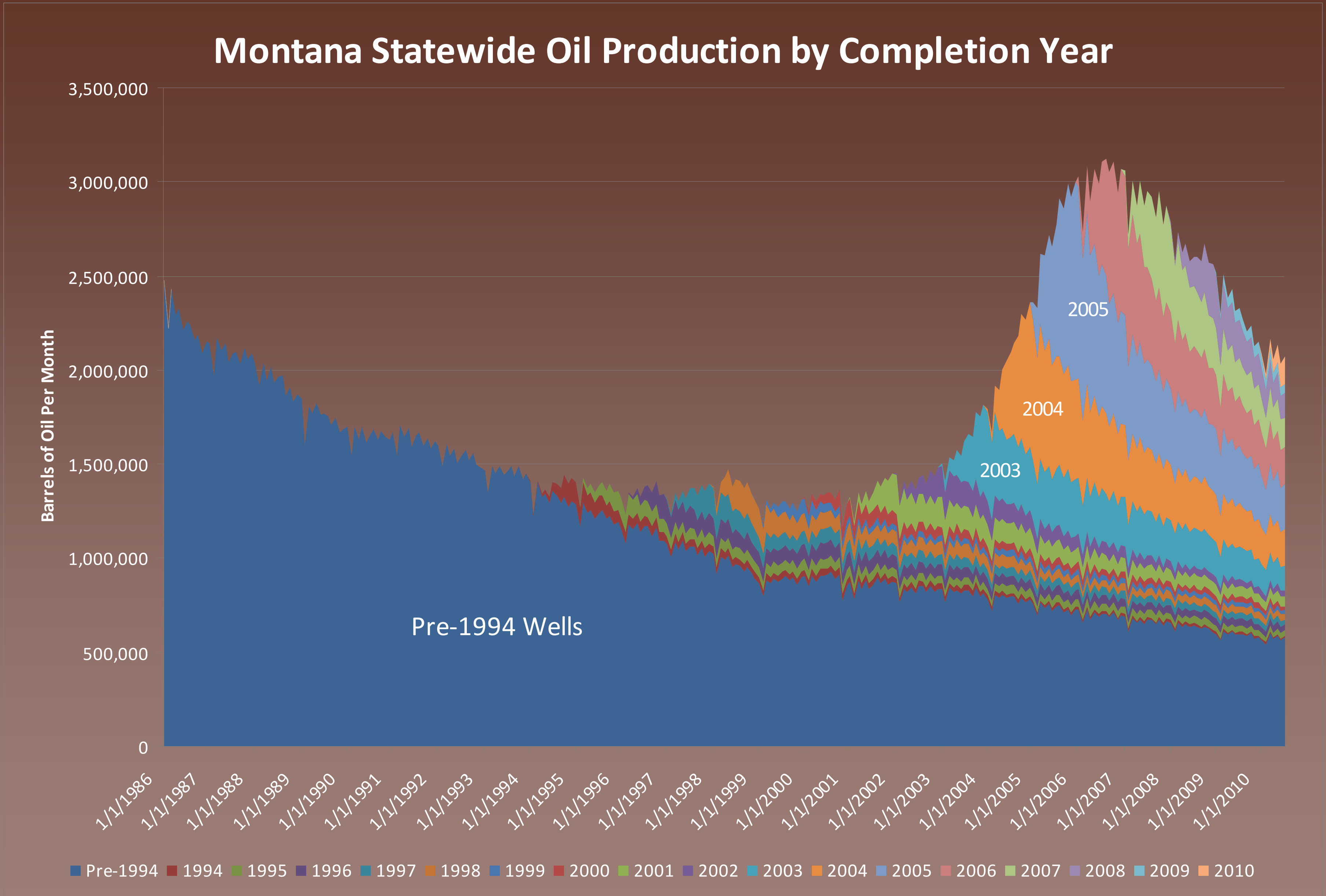
North Dakota Pipeline Authority

November 30, 2010

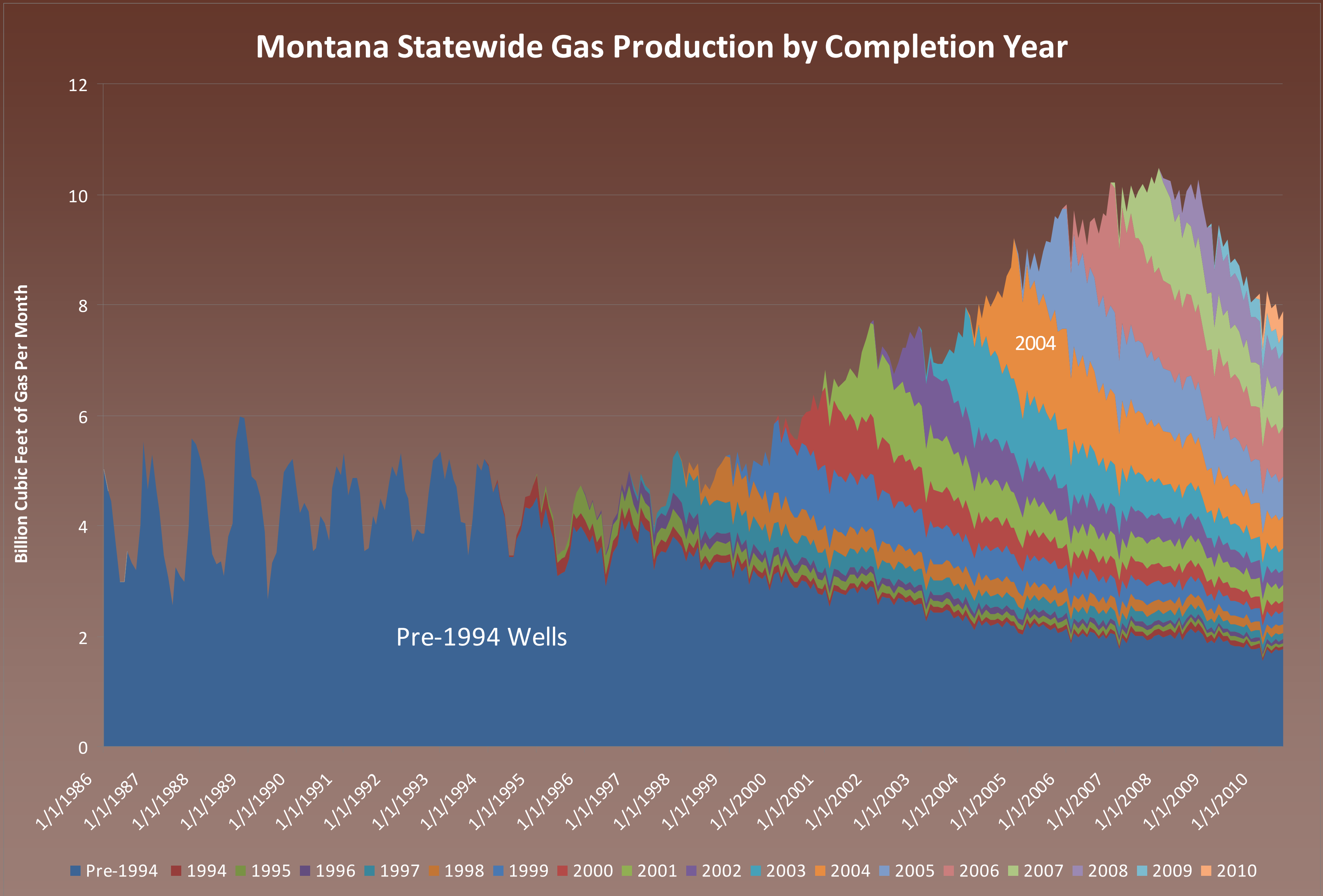
BY

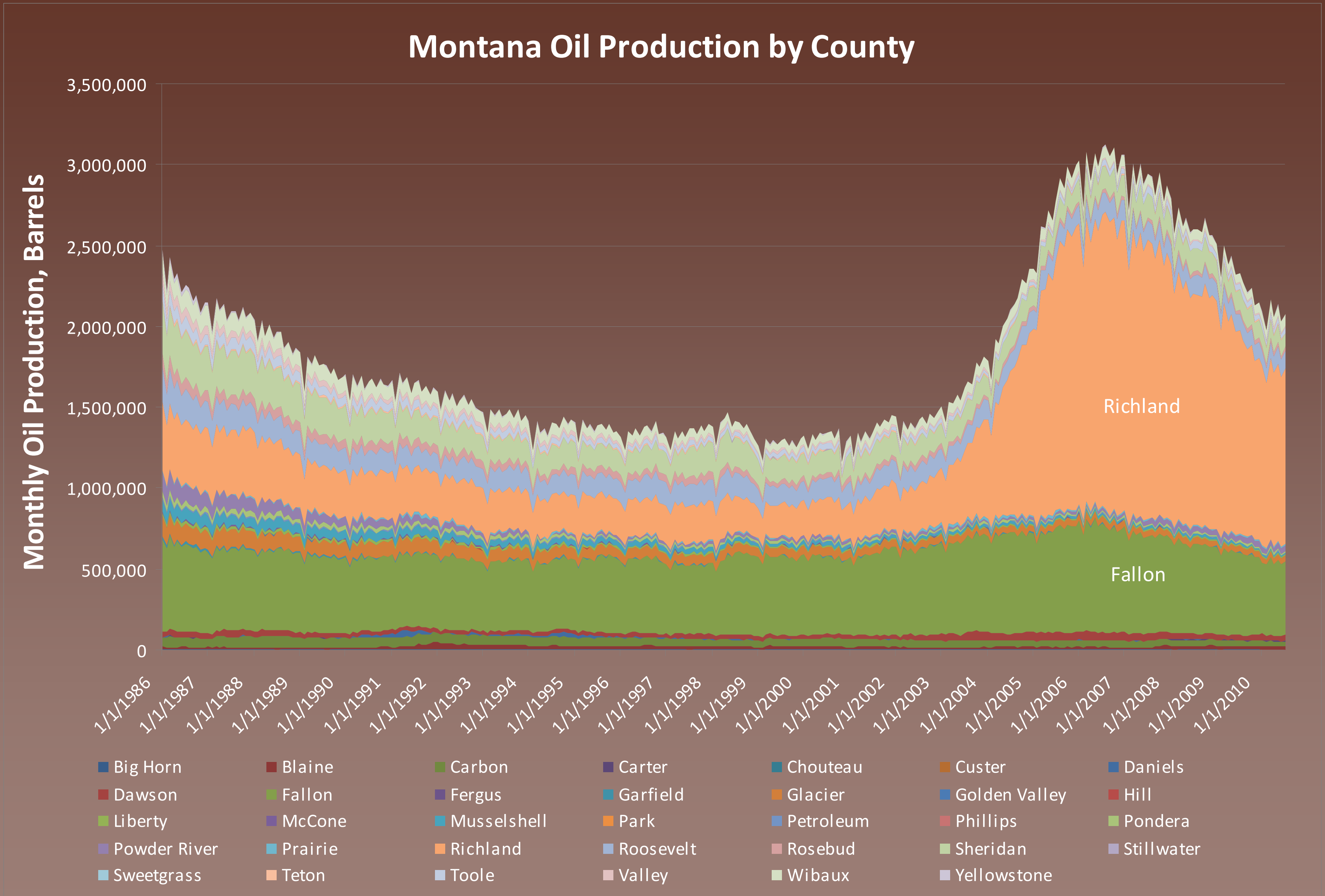
Dave Galt

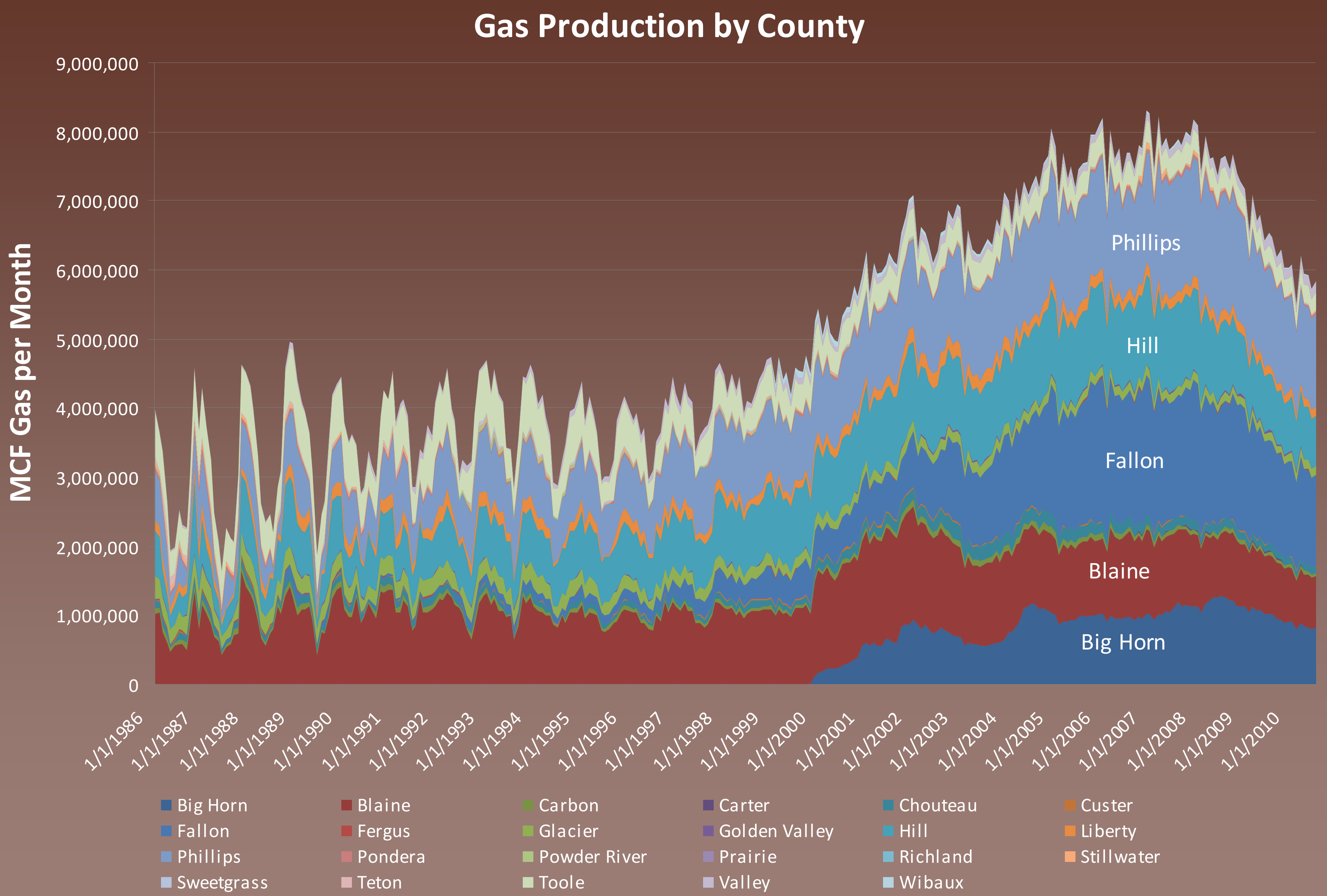
Montana Petroleum Association



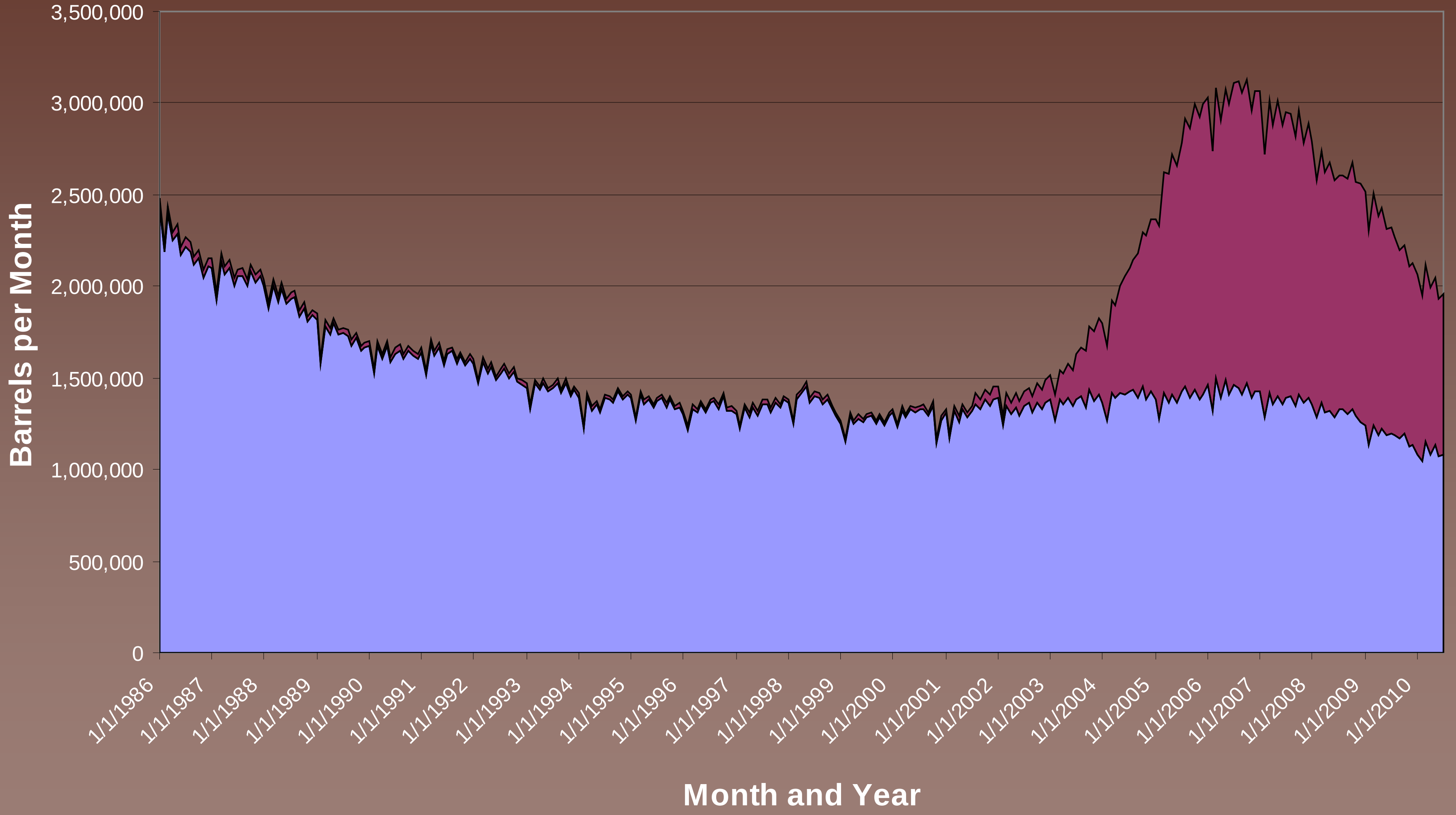
Montana Statewide Oil Production by Completion Year
Barrels of Oil Per Month
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
Pre-1994 Wells
2003
2004
2005
1/1/1986
1/1/1987
1/1/1988
1/1/1989
1/1/1990
1/1/1991
1/1/1992
1/1/1993
1/1/1994
1/1/1995
1/1/1996
1/1/1997
1/1/1998
1/1/1999
1/1/2000
1/1/2001
1/1/2002
1/1/2003
1/1/2004
1/1/2005
1/1/2006
1/1/2007
1/1/2008
1/1/2009
1/1/2010
Pre-1994 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010


Montana Statewide Gas Production by Completion Year
Billion Cubic Feet of Gas Per Month
12
10
8
6
4
2
0
2004
Pre-1994 Wells
1/1/1986
1/1/1987
1/1/1988
1/1/1989
1/1/1990
1/1/1991
1/1/1992
1/1/1993
1/1/1994
1/1/1995
1/1/1996
1/1/1997
1/1/1998
1/1/1999
1/1/2000
1/1/2001
1/1/2002
1/1/2003
1/1/2004
1/1/2005
1/1/2006
1/1/2007
1/1/2008
1/1/2009
1/1/2010
Pre-1994 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

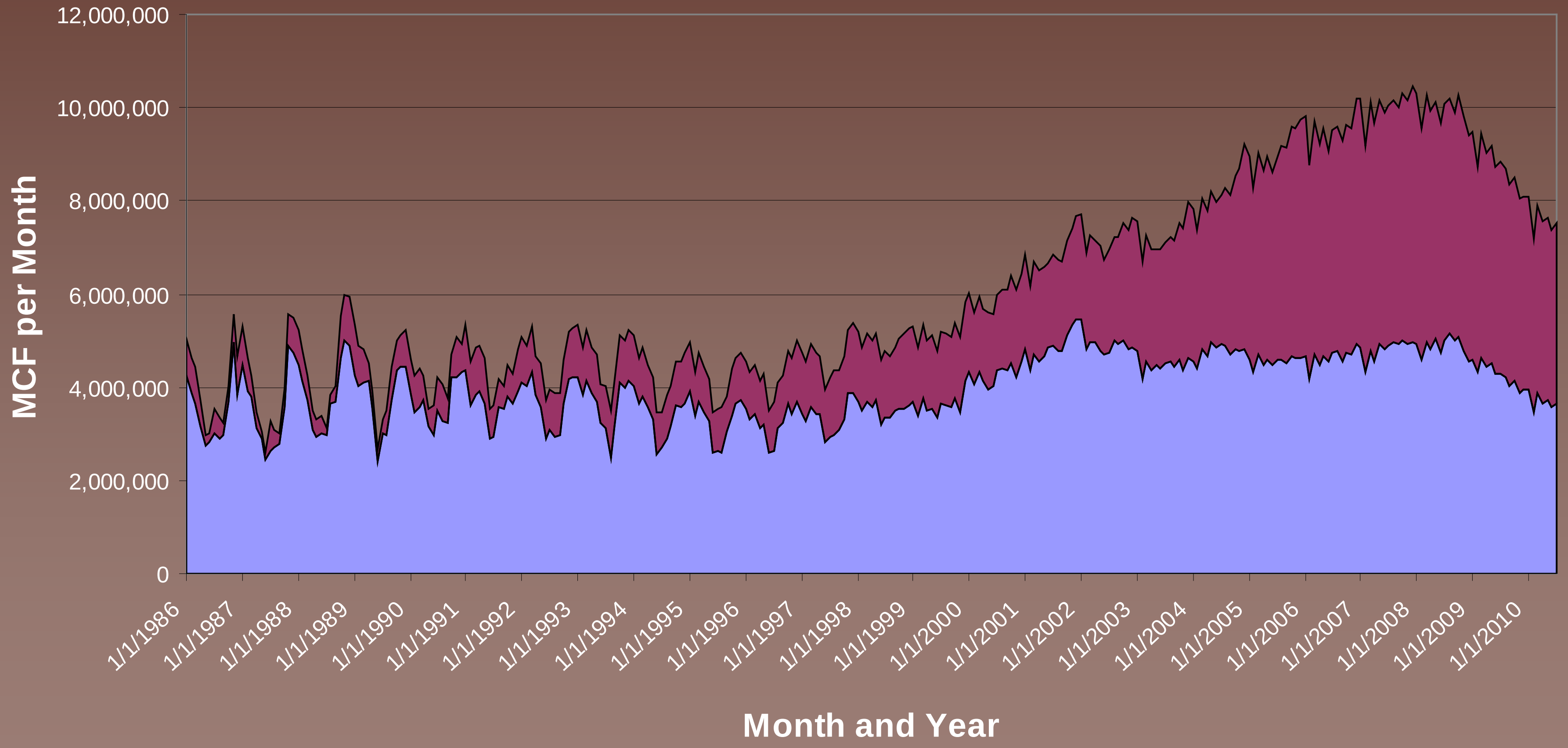

Montana Oil Production by County
Monthly Oil Production, Barrels
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1/1/1986
1/1/1987
1/1/1988
1/1/1989
1/1/1990
1/1/1991
1/1/1992
1/1/1993
1/1/1994
1/1/1995
1/1/1996
1/1/1997
1/1/1998
1/1/1999
1/1/2000
1/1/2001
1/1/2002
1/1/2003
1/1/2004
1/1/2005
1/1/2006
1/1/2007
1/1/2008
1/1/2009
1/1/2010
Richland
Fallon
Big Horn
Blaine
Carbon
Carter
Chouteau
Custer
Daniels
Dawson
Fallon
Fergus
Garfield
Glacier
Golden Valley
Hill
Liberty
McCone
Musselshell
Park
Petroleum
Phillips
Pondera
Powder River
Prairie
Richland
Roosevelt
Rosebud
Sheridan
Stillwater
Sweetgrass
Teton
Toole
Valley
Wibaux
Yellowstone


Gas Production by County
MCF Gas per Month
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
0
1/1/1986
1/1/1987
1/1/1988
1/1/1989
1/1/1990
1/1/1991
1/1/1992
1/1/1993
1/1/1994
1/1/1995
1/1/1996
1/1/1997
1/1/1998
1/1/1999
1/1/2000
1/1/2001
1/1/2002
1/1/2003
1/1/2004
1/1/2005
1/1/2006
1/1/2007
1/1/2008
1/1/2009
1/1/2010
Phillips
Hill
Fallon
Blaine
Big Horn
Big Horn
Blaine
Carbon
Carter
Chouteau
Custer
Fallon
Fergus
Glacier
Golden Valley
Hill
Liberty
Phillips
Pondera
Powder River
Prairie
Richland
Stillwater
Sweetgrass
Teton
Toole
Valley
Wibaux

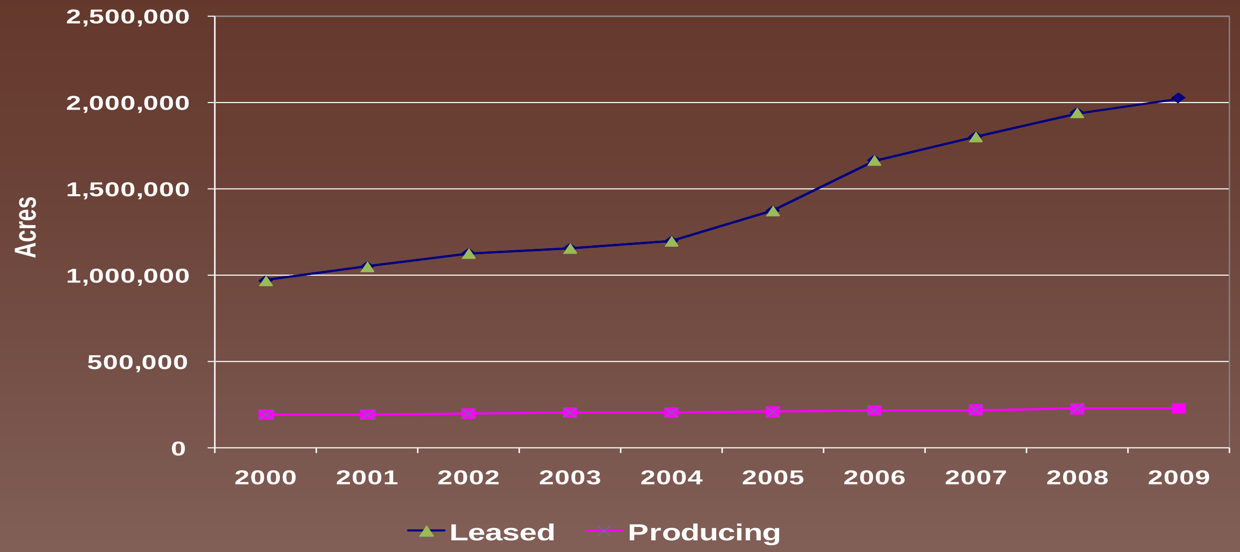
Total Monthly Oil Production With Estimated Contribution from Hydraulic Fracturing



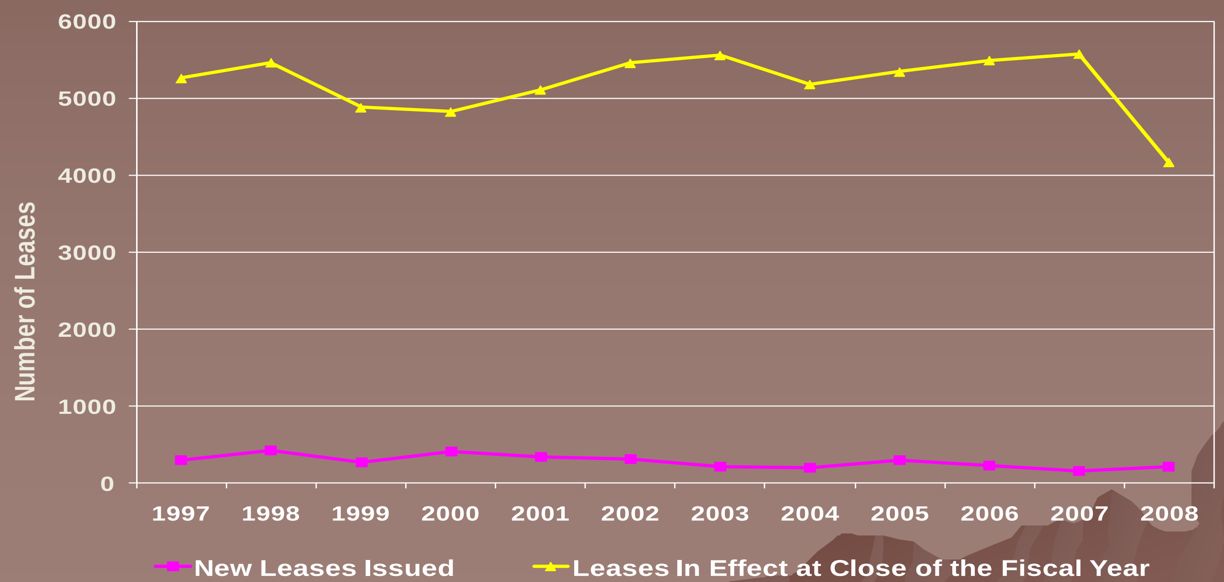
Total Monthly Gas Production With Estimated Contribution from Hydraulic Fracturing



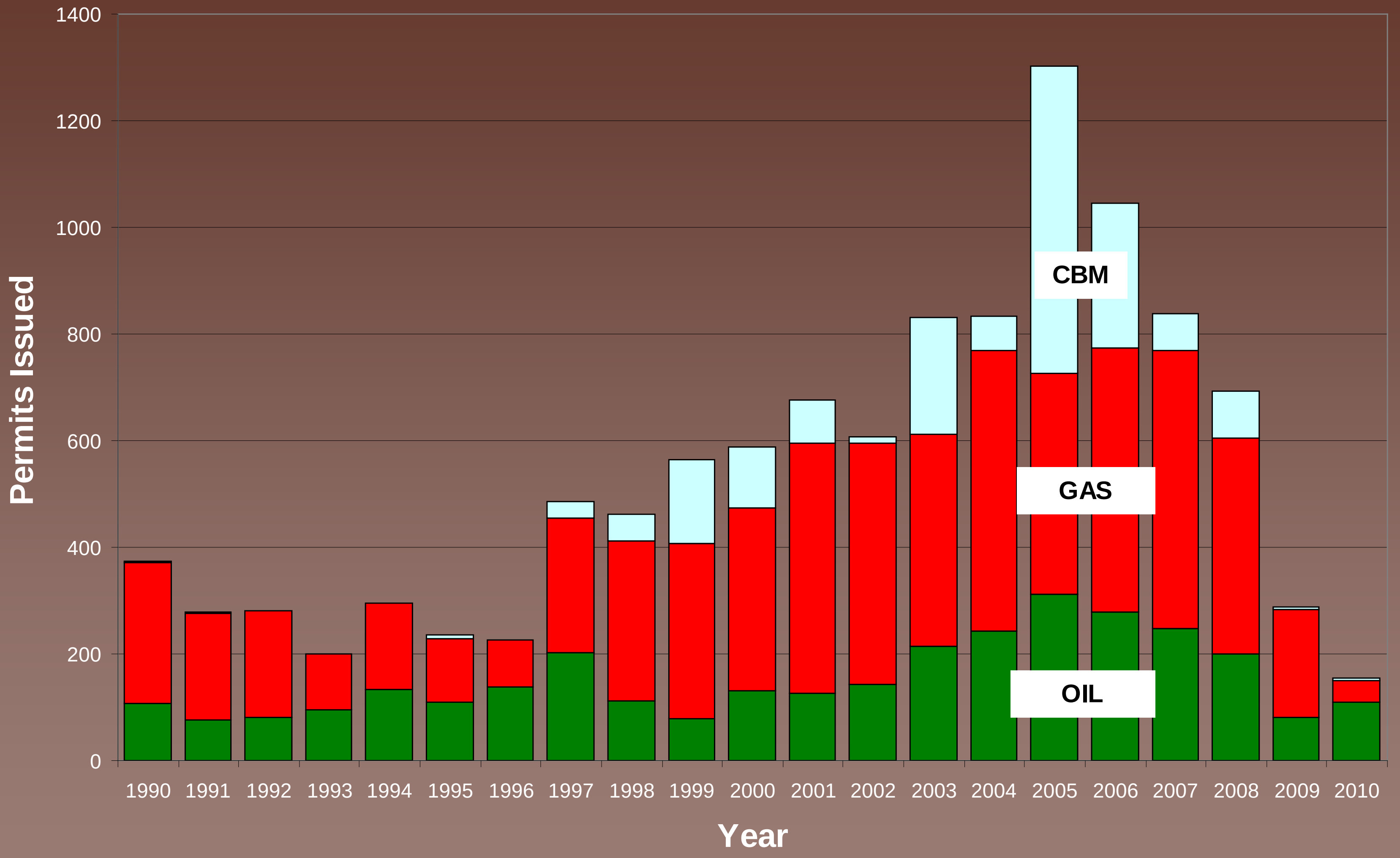
State Acres Leased & Producing



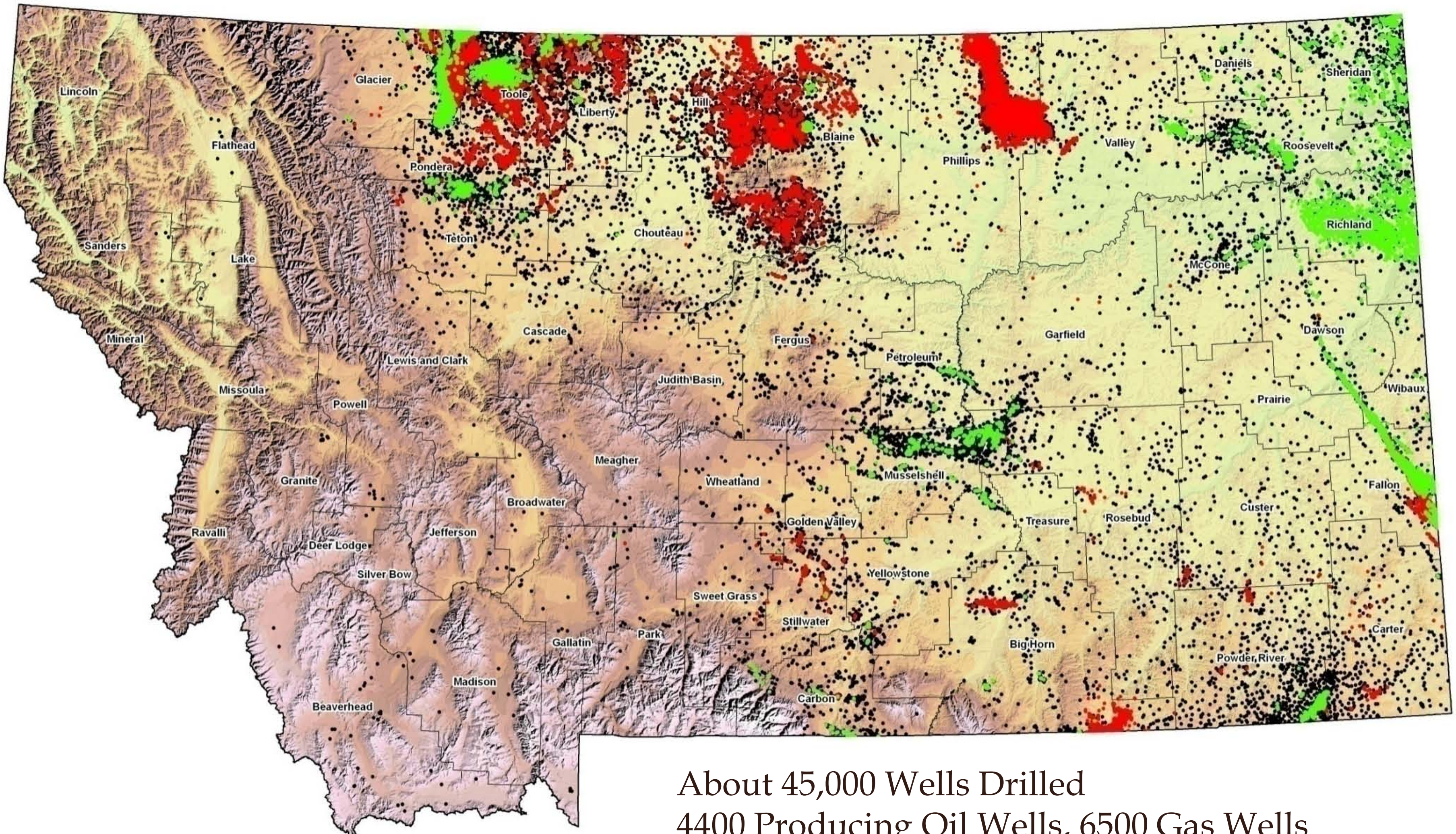
Federal Leasing Activity In Montana



Drilling Permits Issued, by Year (Through June 2010)

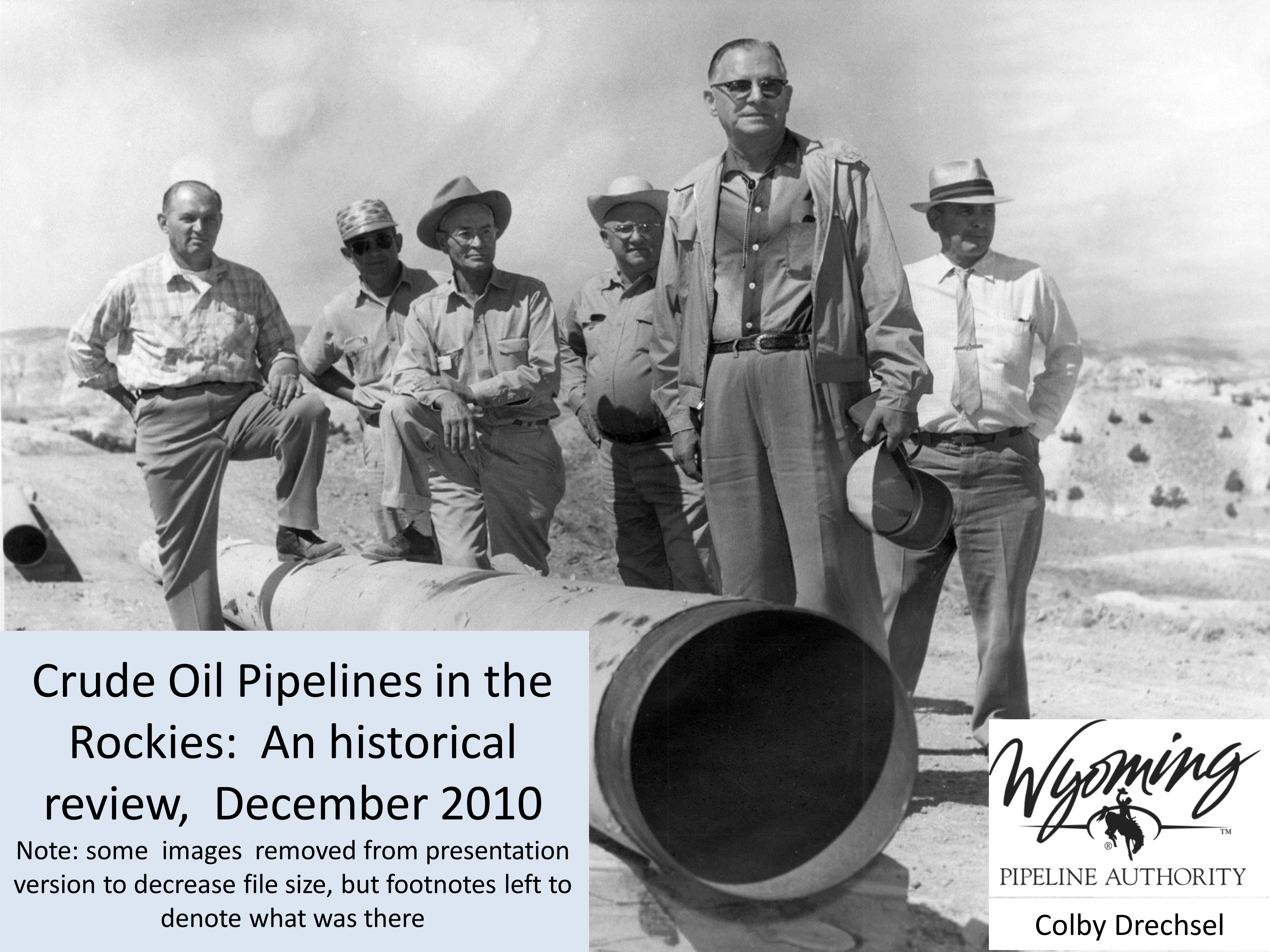


Montana Production and Penetrations



About 45,000 Wells Drilled
4400 Producing Oil Wells, 6500 Gas Wells

Updated as of May, 2009



Crude Oil Pipelines in the Rockies: An historical review, December 2010

Note: some images removed from presentation version to decrease file size, but footnotes left to denote what was there

PIPELINE AUTHORITY

Colby Drechsel

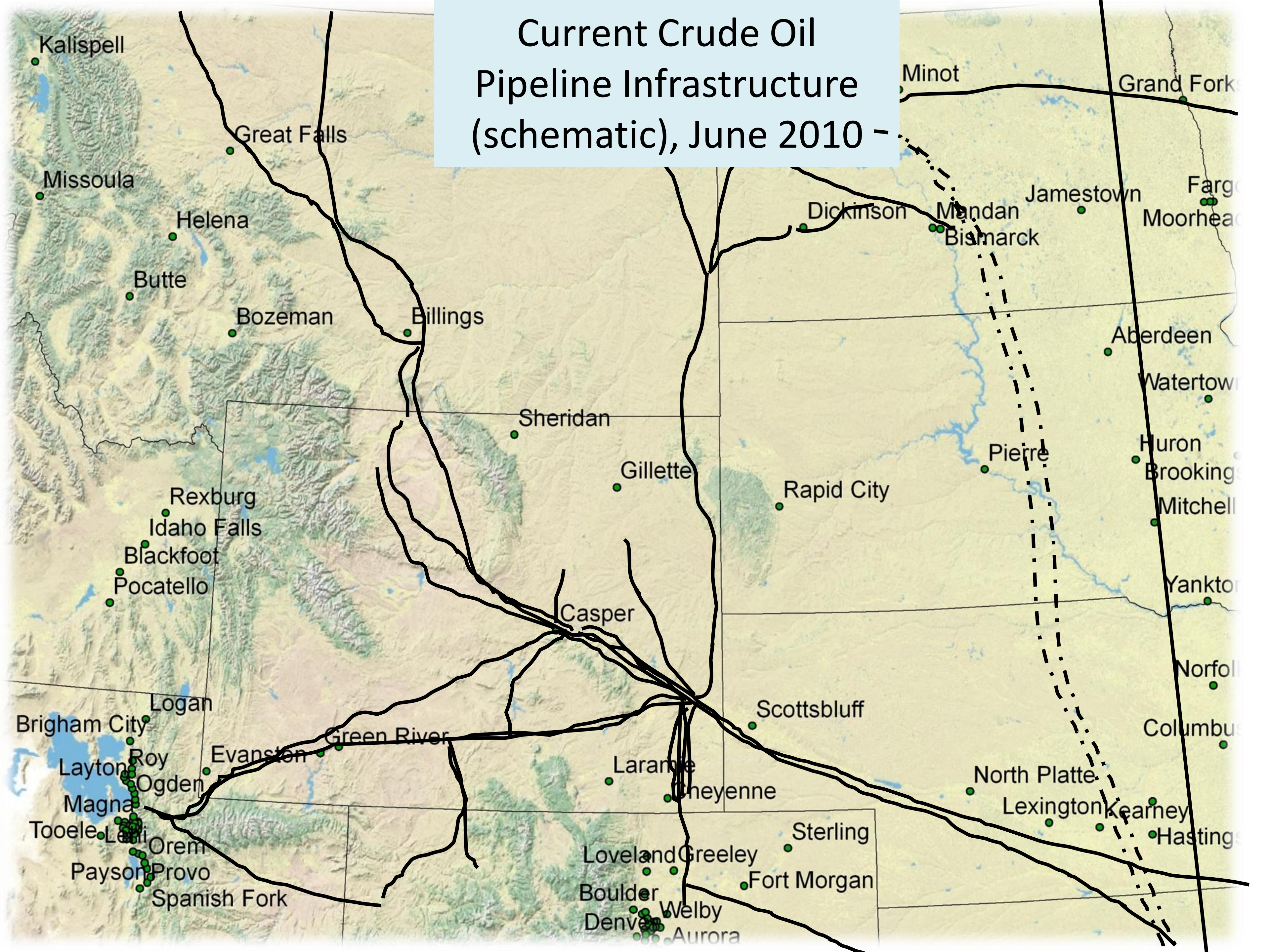
Presentation Outline

- WPA background
- Crude oil infrastructure build-out per decade/consumer economic impact
- Anticipated Rockies crude oil production and respective pipeline capacity growth

Opening slide, 1950? ca. Kinder Morgan Collection, Casper College Western History Center "people take an interest in history when they have a vested interest in the future" - JL

1900 ca. USGS Photo Library

Current Crude Oil Pipeline Infrastructure (schematic), June 2010

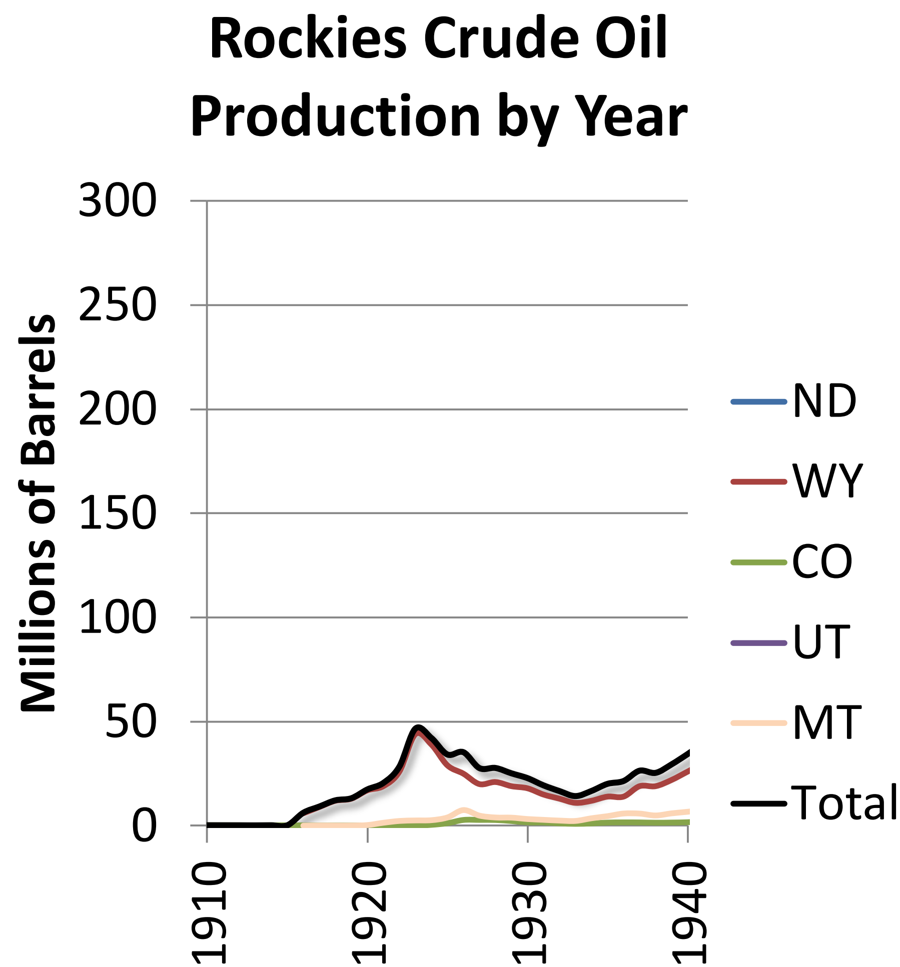


Colorado, first drilling boom, Florence Oil Field, 1880

Utah, discovers oil north of SLC, Farmington Bay area in 1891

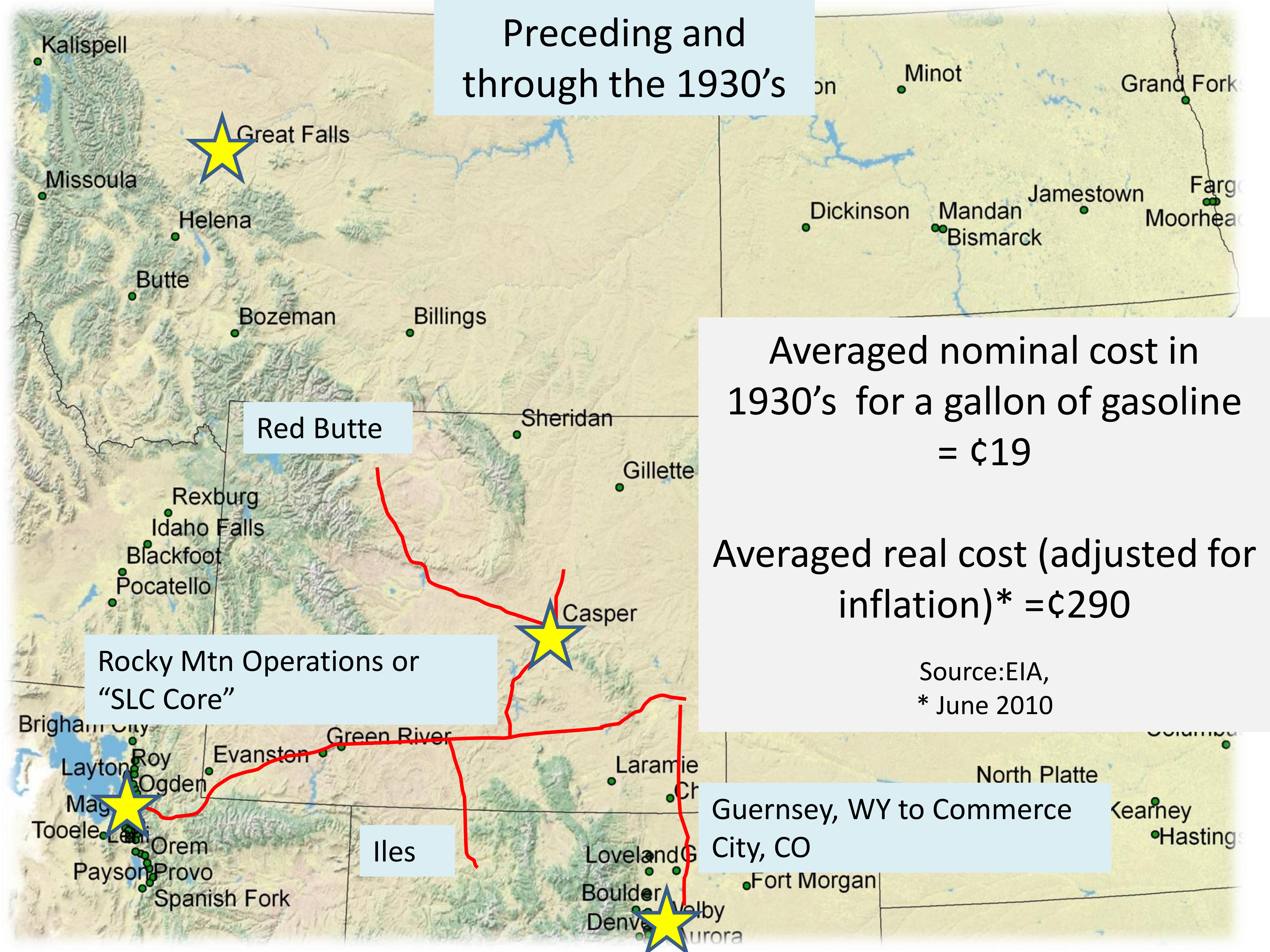
Wyoming, Marathon begins commercial production in 1912

Preceding and through the 1930's



Pipeline to Ft. Washakie, (late 1920), Kinder Morgan Collection, Casper College Western History Center

Preceding and through the 1930's

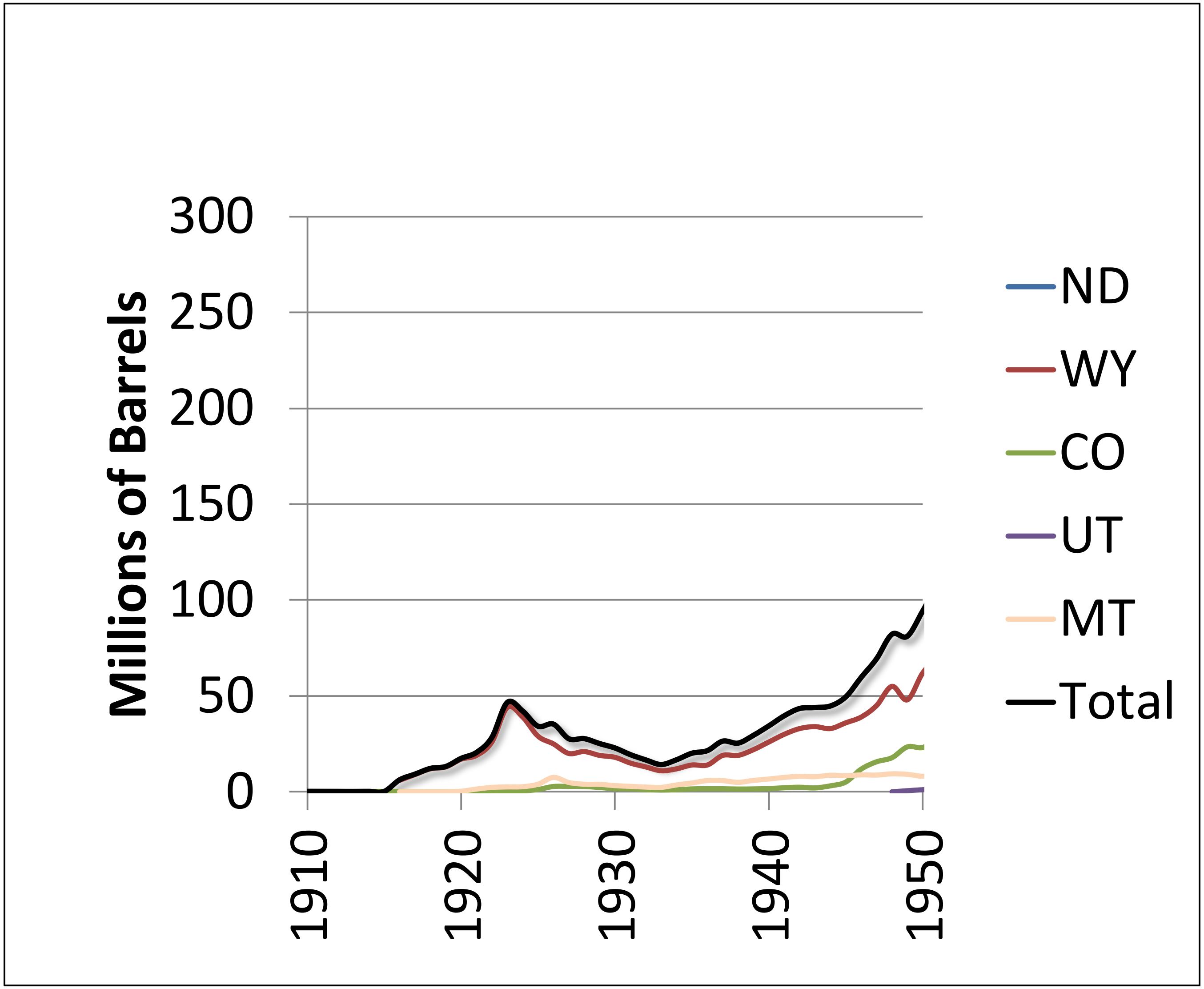


Averaged nominal cost in 1930's for a gallon of gasoline = ¢19

Averaged real cost (adjusted for inflation)* =¢290

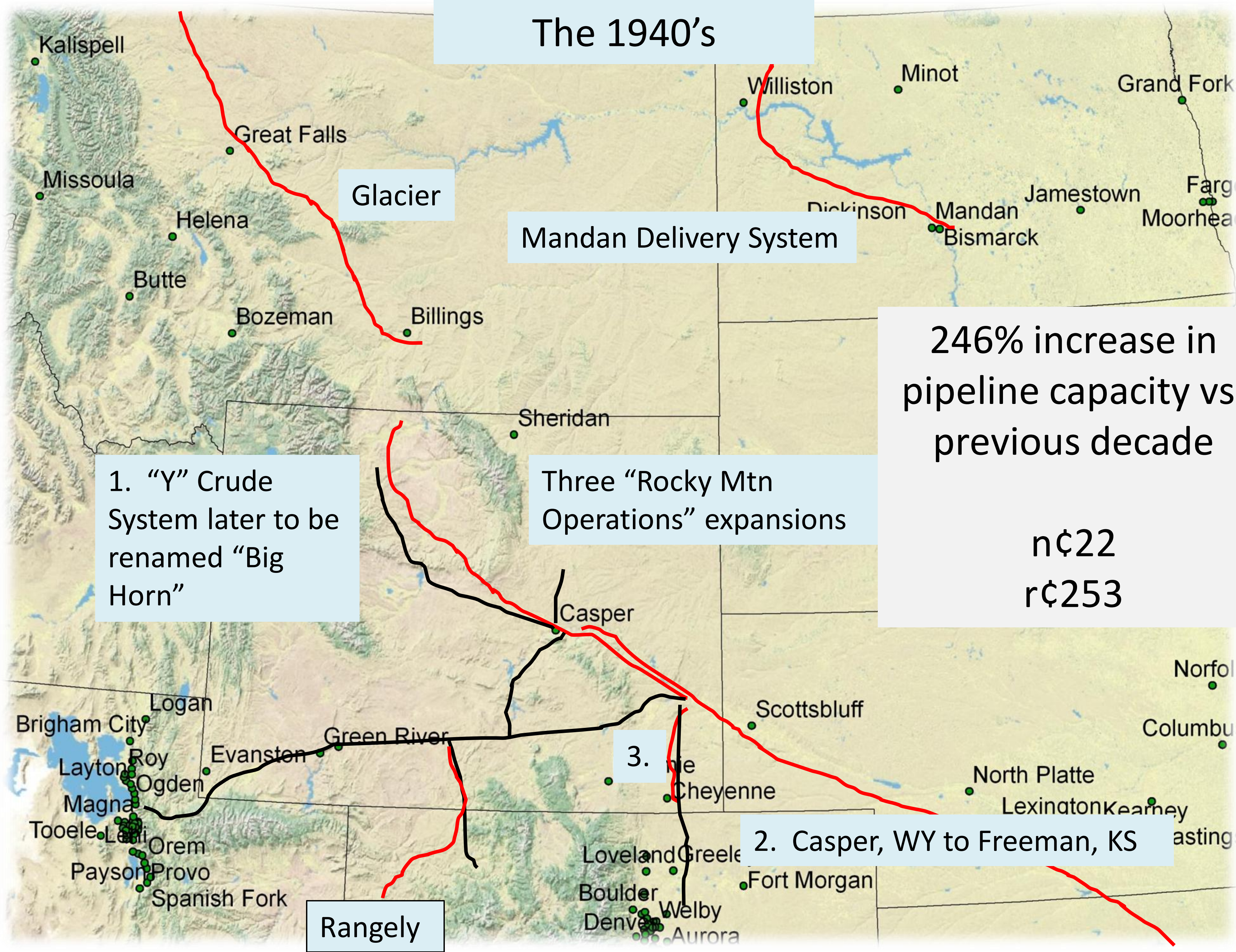
Source:EIA,
* June 2010

The 1940's



Pipe fitter gang. 1940? ca. BP (Amoco) Collection,
Casper College Western History Center

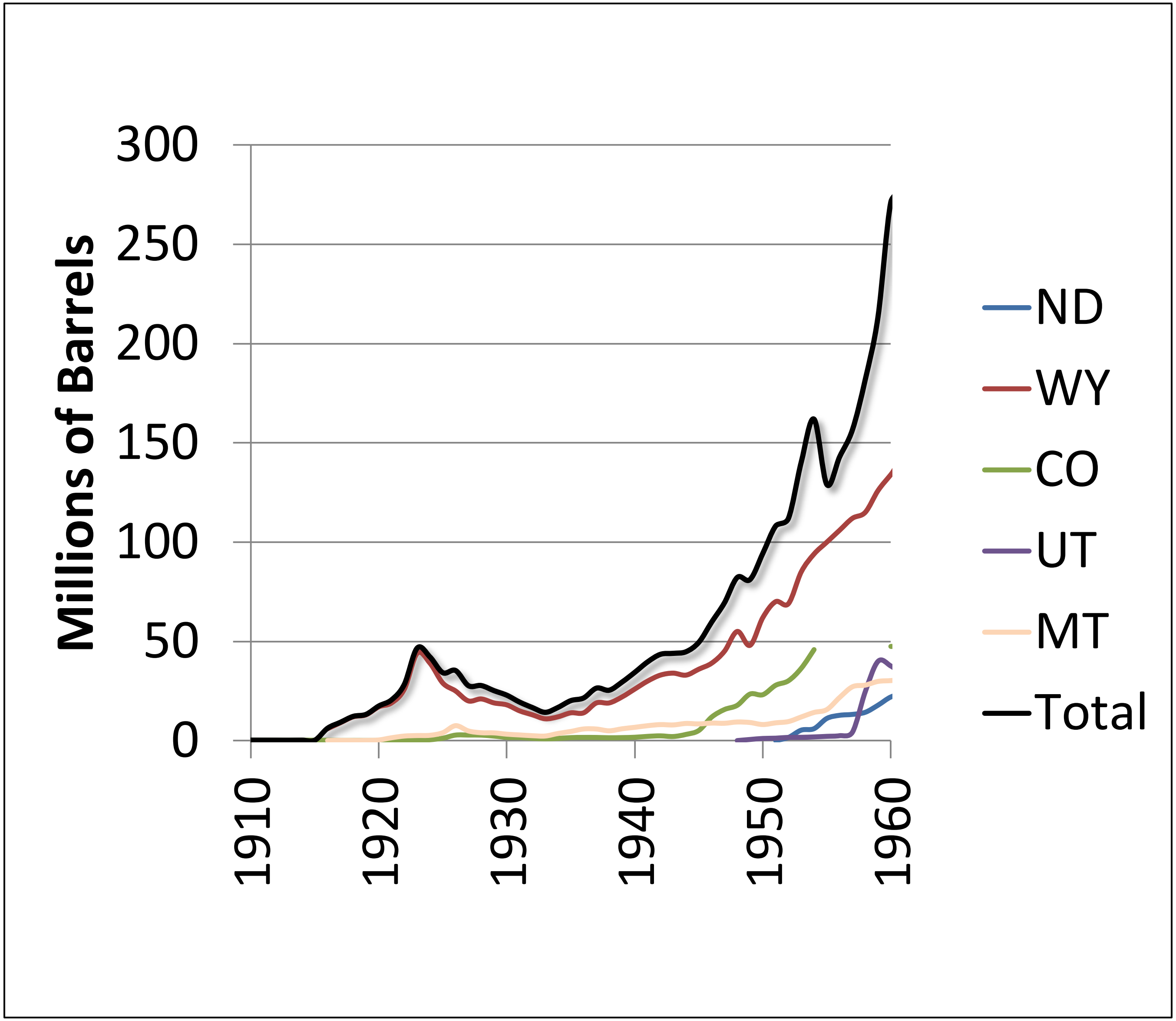
The 1940's



246% increase in pipeline capacity vs. previous decade

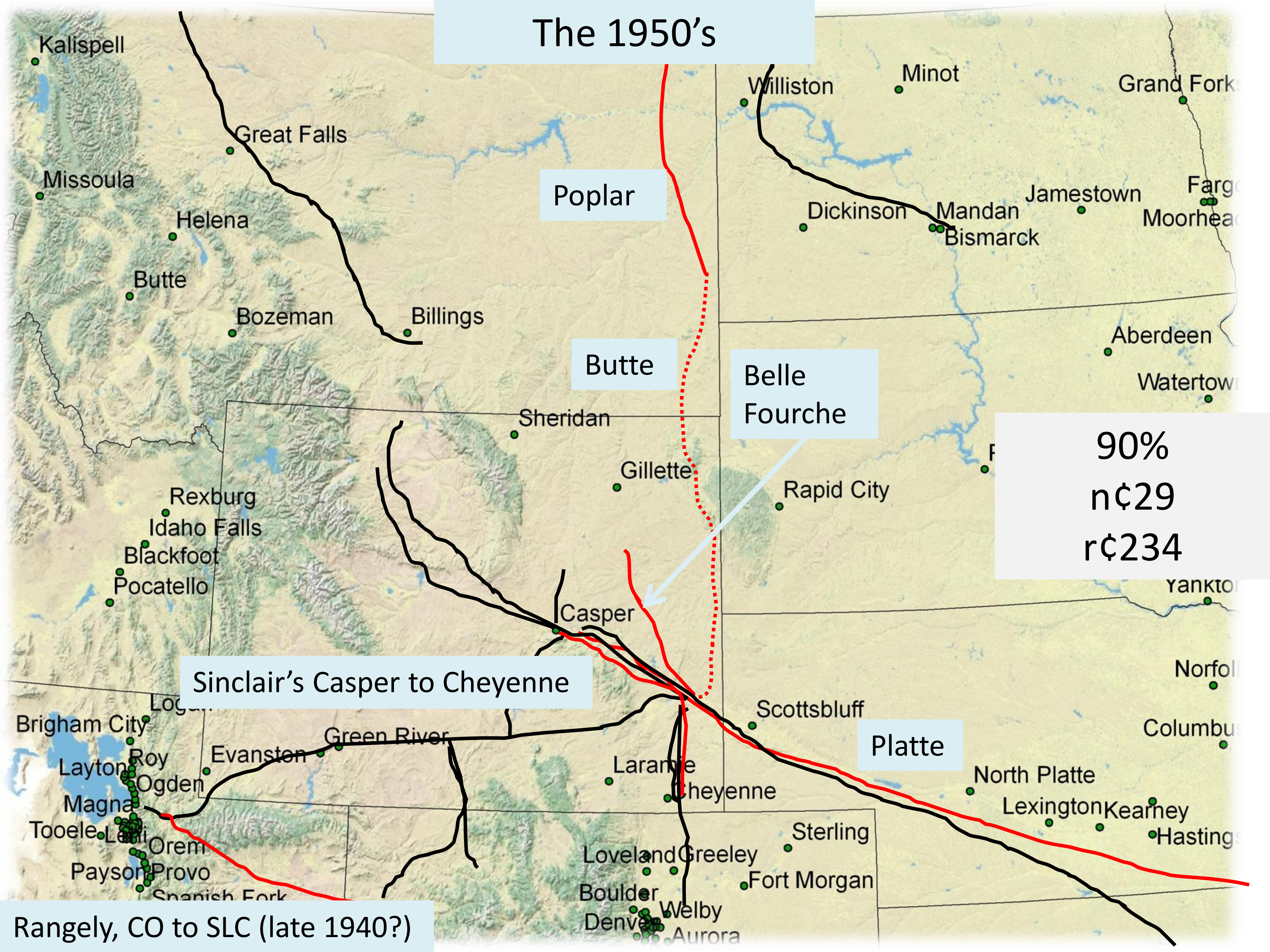
n¢22
r¢253

The 1950's

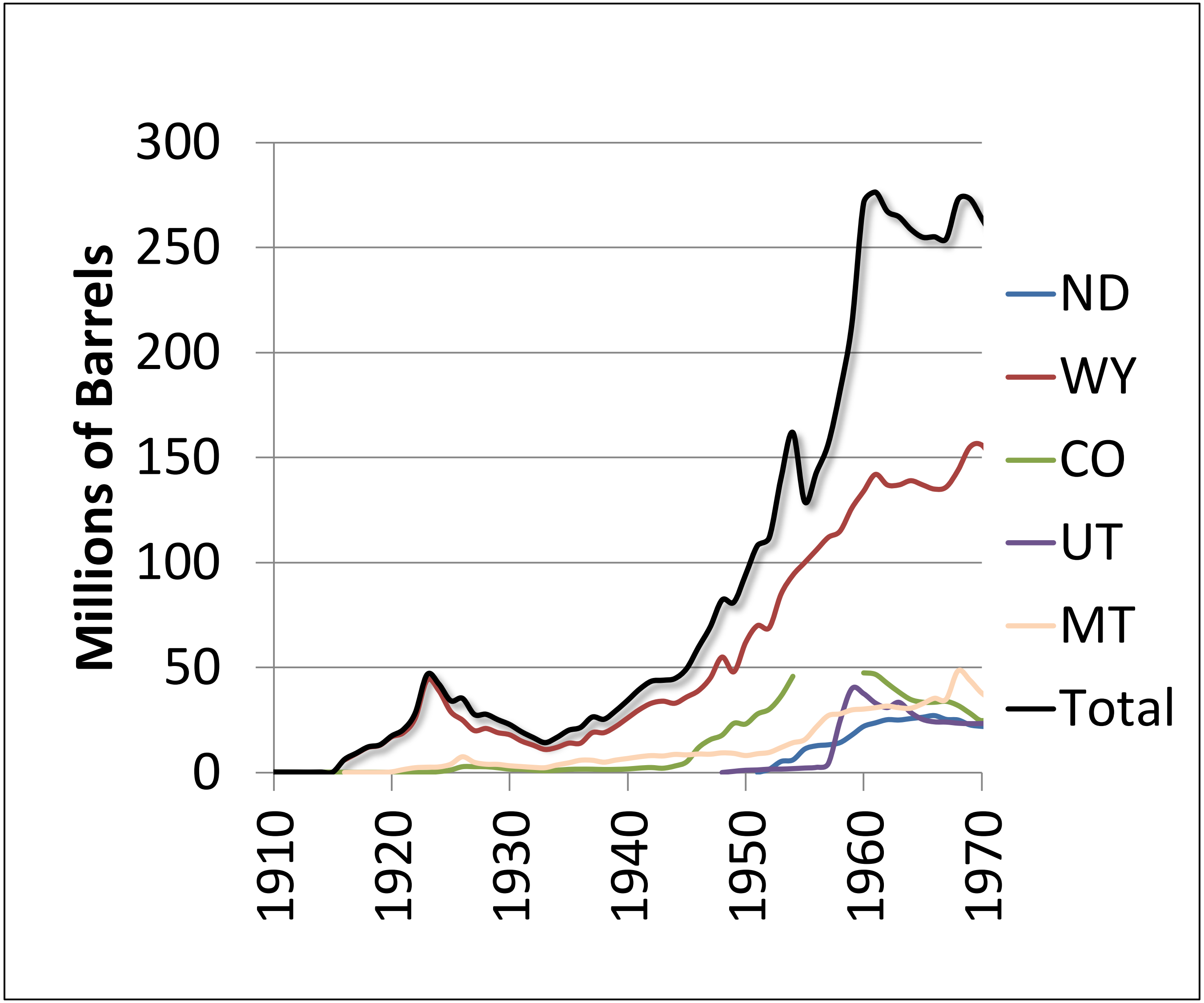


Casper Gas Appliance Co, Incorporated. 1950's? ca. Kinder Morgan Collection, Casper College Western History Center

The 1950's


Poplar
Butte
Belle Fourche
90%
n¢29
r¢234
Sinclair's Casper to Cheyenne
Platte
Rangely, CO to SLC (late 1940?)
Kalispell
Great Falls
Missoula
Helena
Butte
Bozeman
Billings
Williston
Minot
Grand Fork
Dickinson
Mandan
Bismarck
Jamestown
Farg
Moorhea
Aberdeen
Watertow
Sheridan
Gillette
Rapid City
Rexburg
Idaho Falls
Blackfoot
Pocatello
Yankto
Casper
Brigham City
Roy
Layton
Ogden
Evanston
Green River
Magna
Tooele
Orem
Payson
Provo
Laramie
Cheyenne
Scottsbluff
Norfol
Columbu
North Platte
Lexington
Kearney
Hasting
Sterling
Loveland
Greeley
Fort Morgan
Boulder
Welby
Denver
Aurora

The 1960's

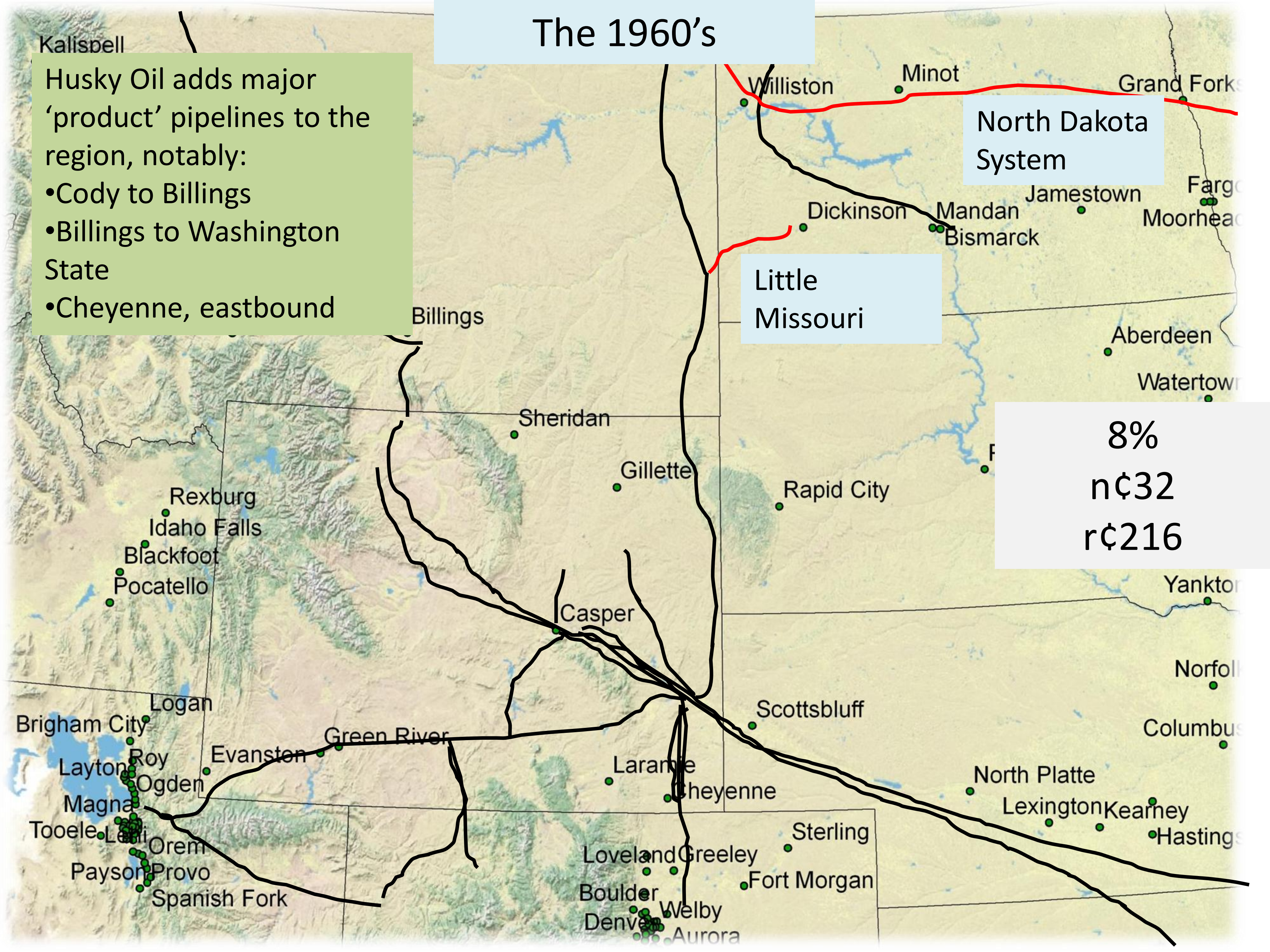


Sa_s___16 inch line to Casper. (1968). Kinder Morgan Collection, Casper College Western History Center

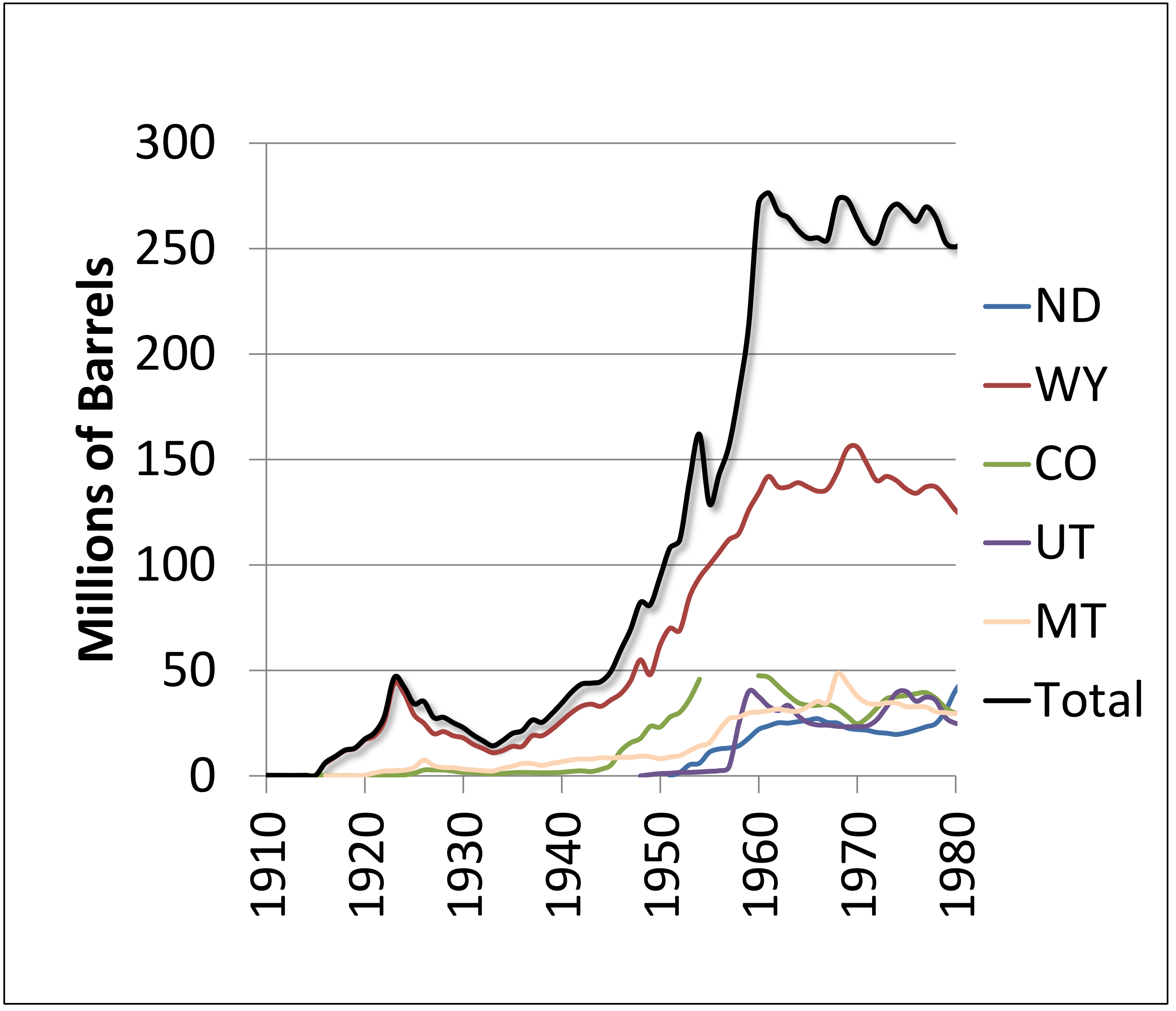
The 1960's

Husky Oil adds major 'product' pipelines to the region, notably:

- Cody to Billings
- Billings to Washington State
- Cheyenne, eastbound



The 1970's



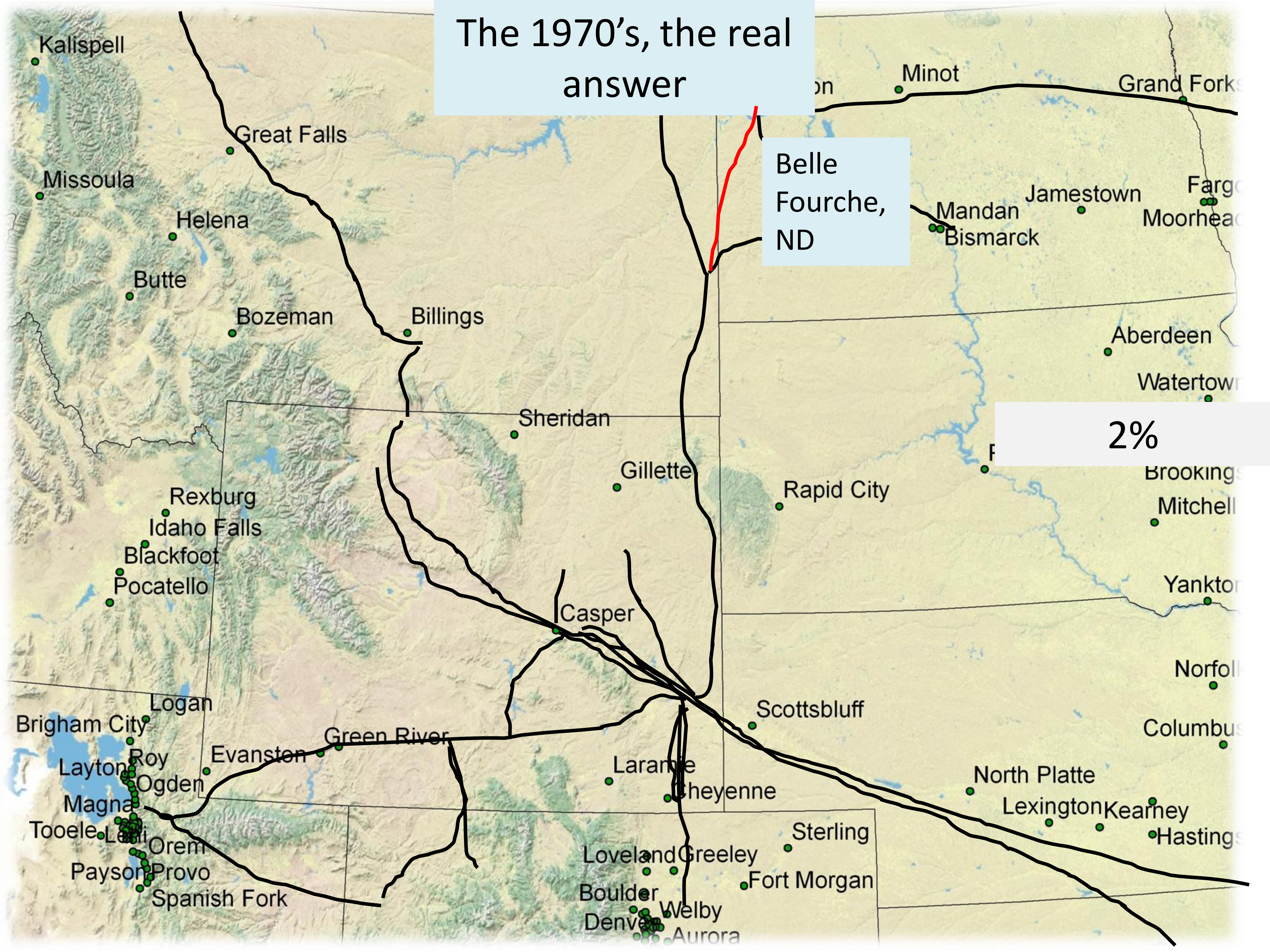
Pipeline Control Panel, Bear Creek, Slater. Amoco or WYCO (1977). BP (Amoco) Collection, Casper College Western History Center

The 1970's

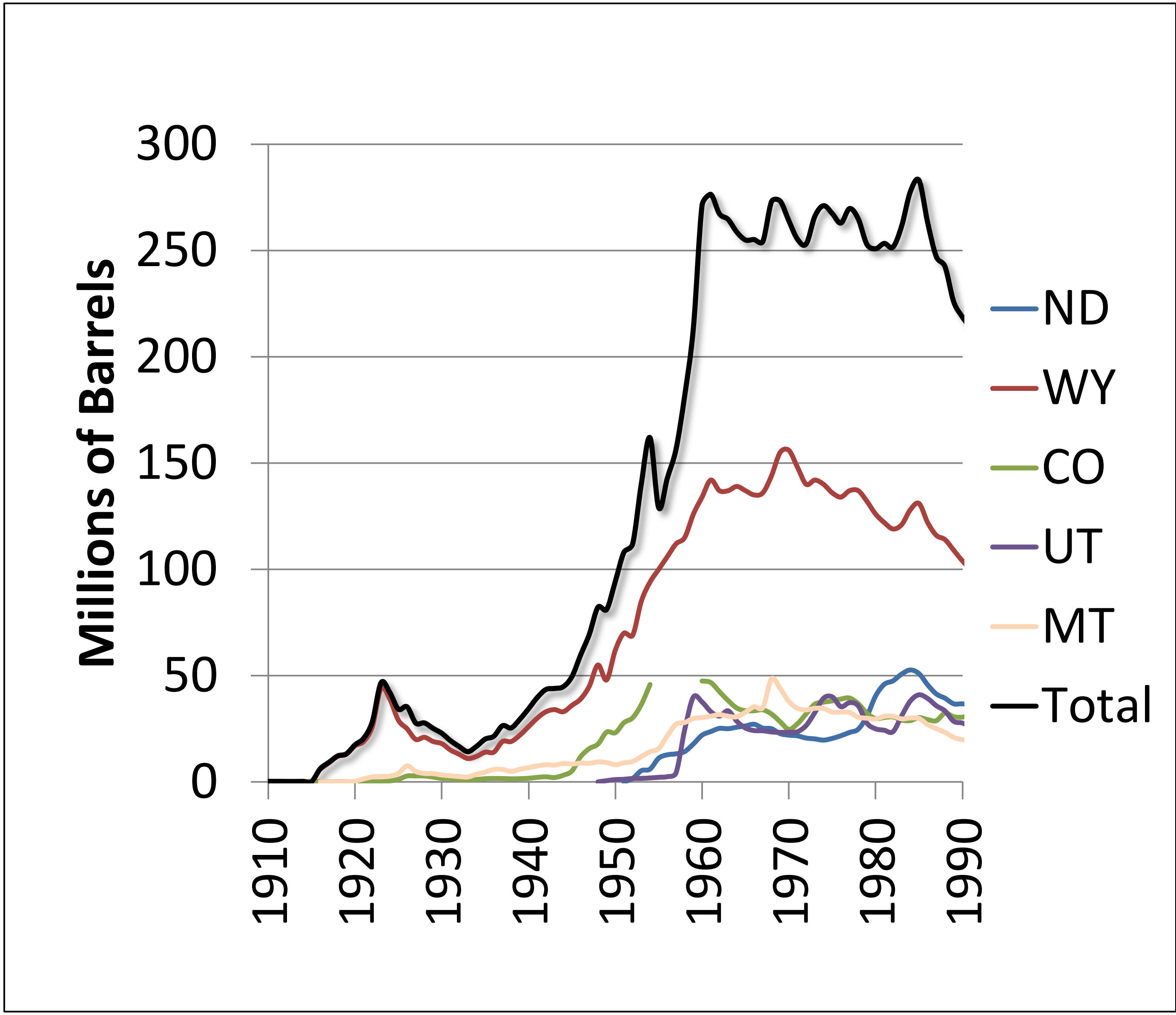
n¢59
r¢228

Obviously nothing got done . . . but at least we got some color pictures for the slide show!

The 1970's, the real answer

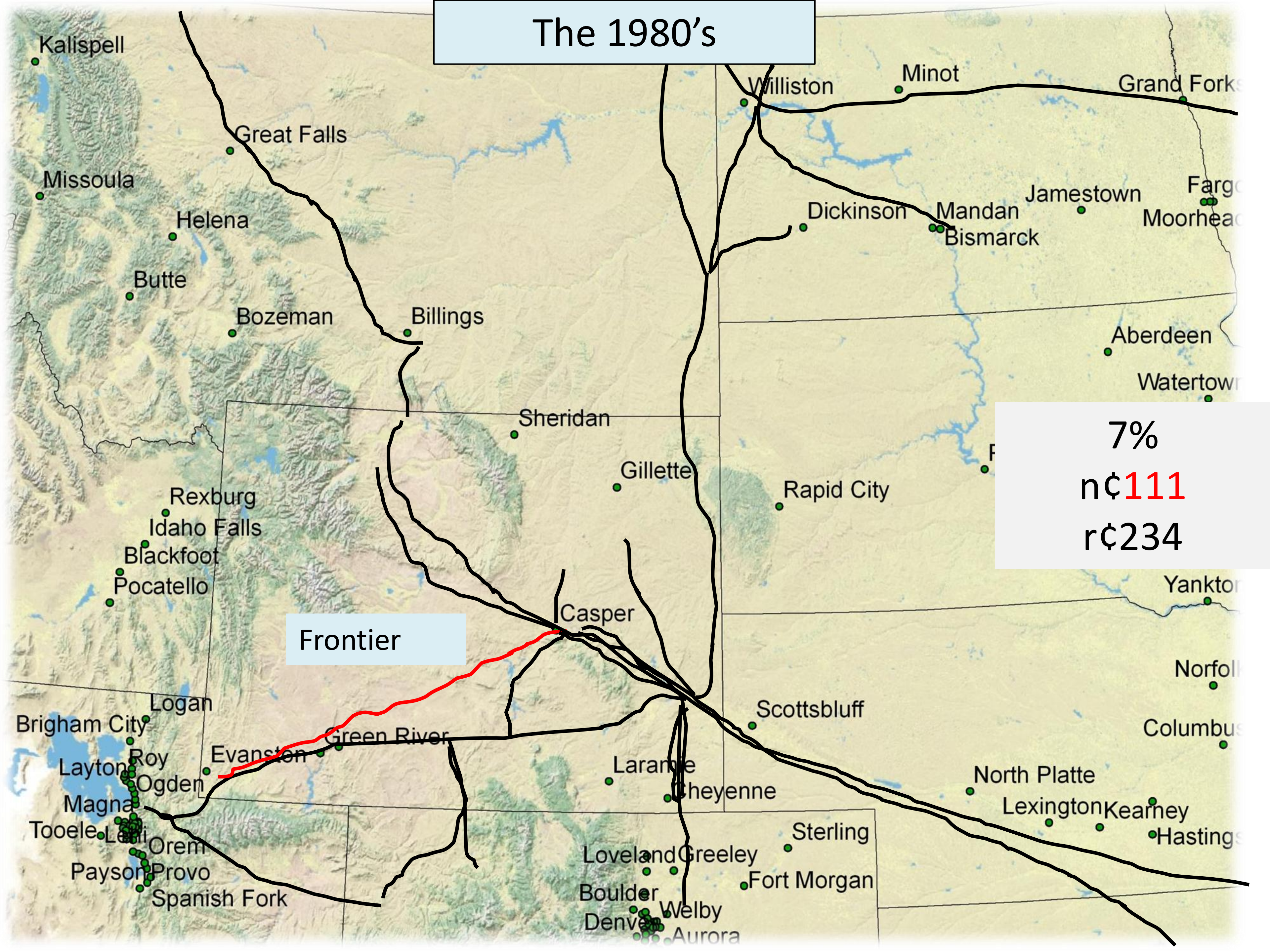


The 1980's



1980? ca. Kinder Morgan Collection, Casper College Western History Center

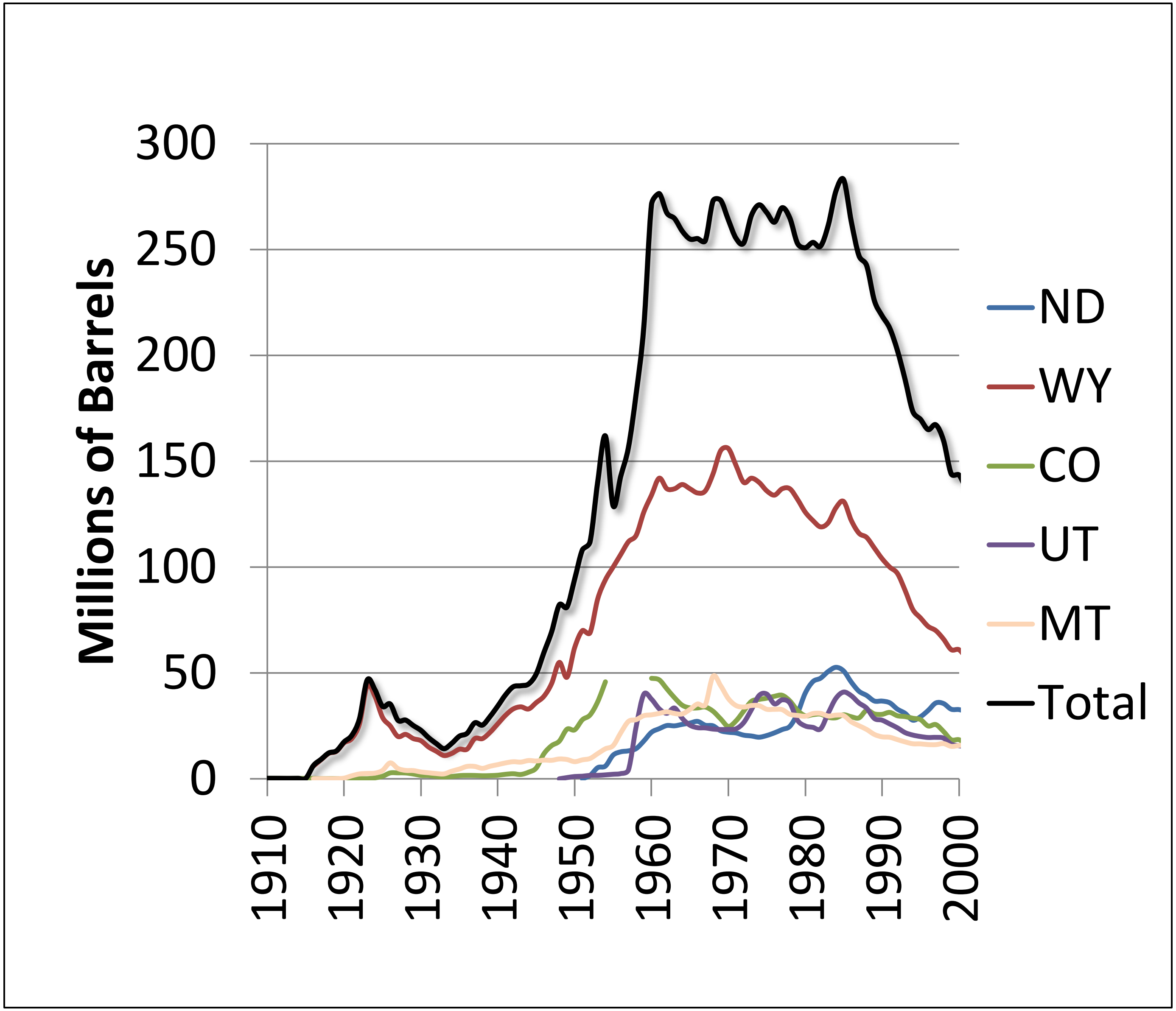
The 1980's



Frontier

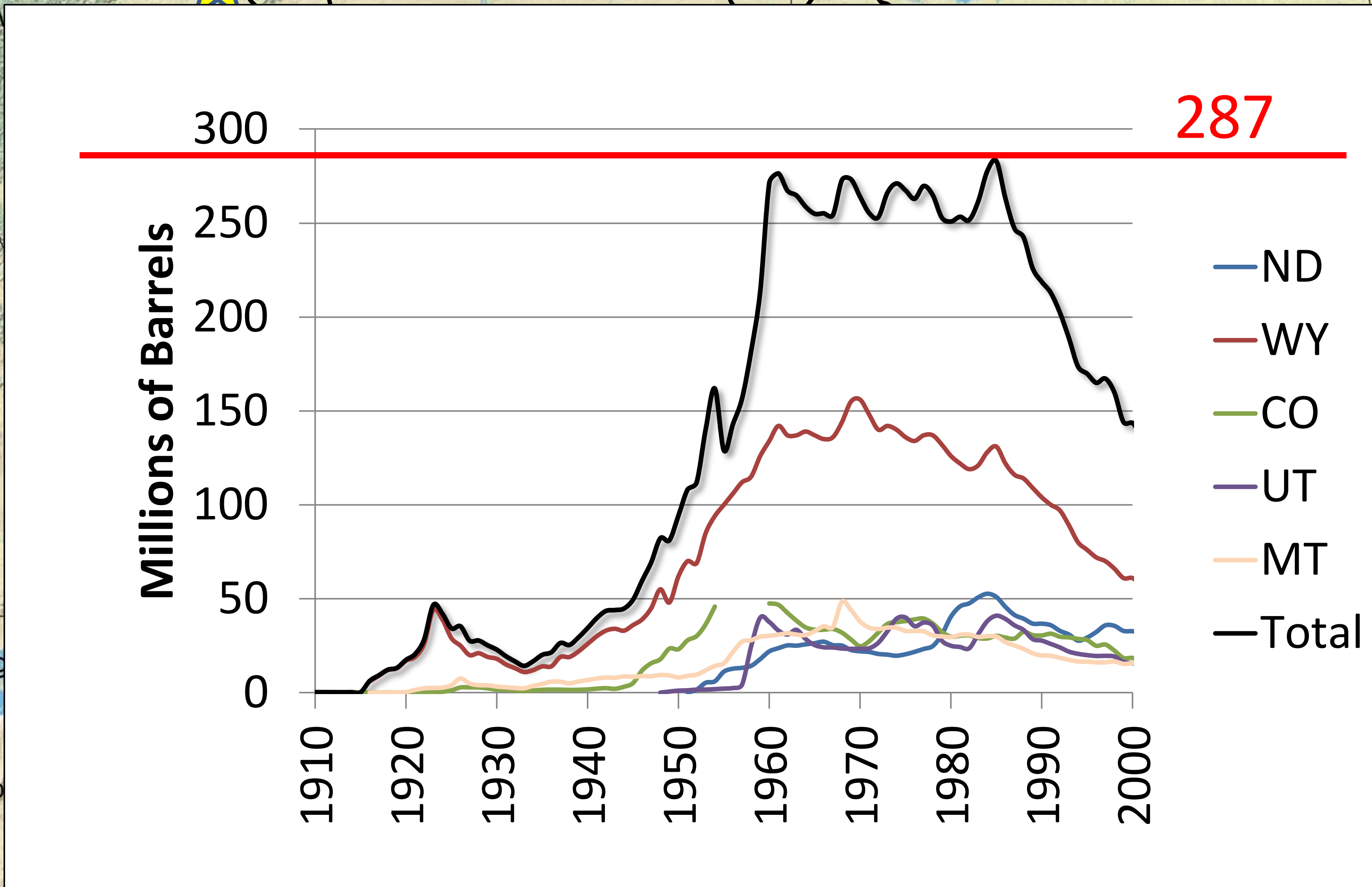
7%
n¢111
r¢234

The 1990's



Stock photo courtesy of Questar Corporation. Undated.

Production vs. Refining Capacity (throughput)

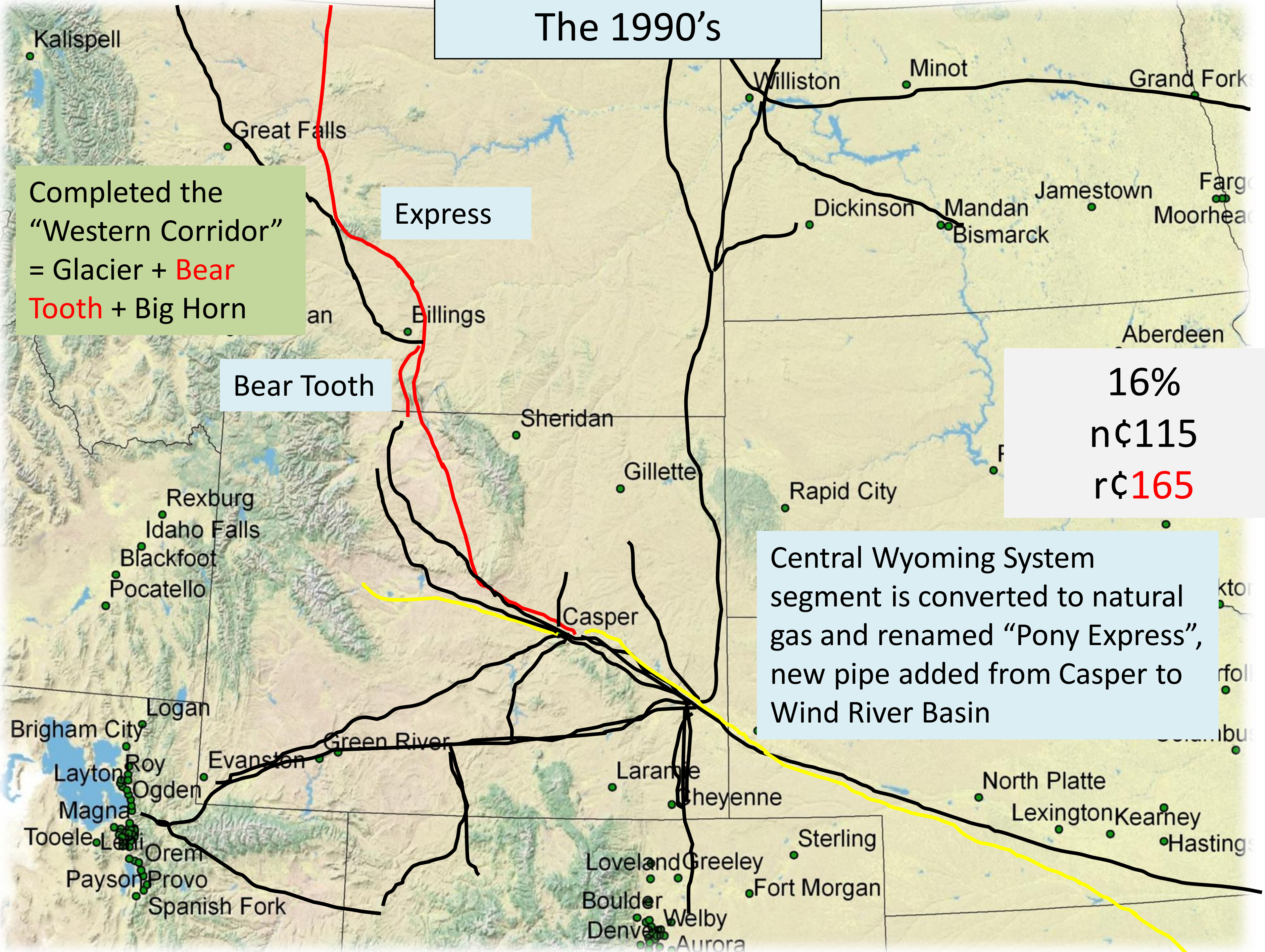


The 1990's

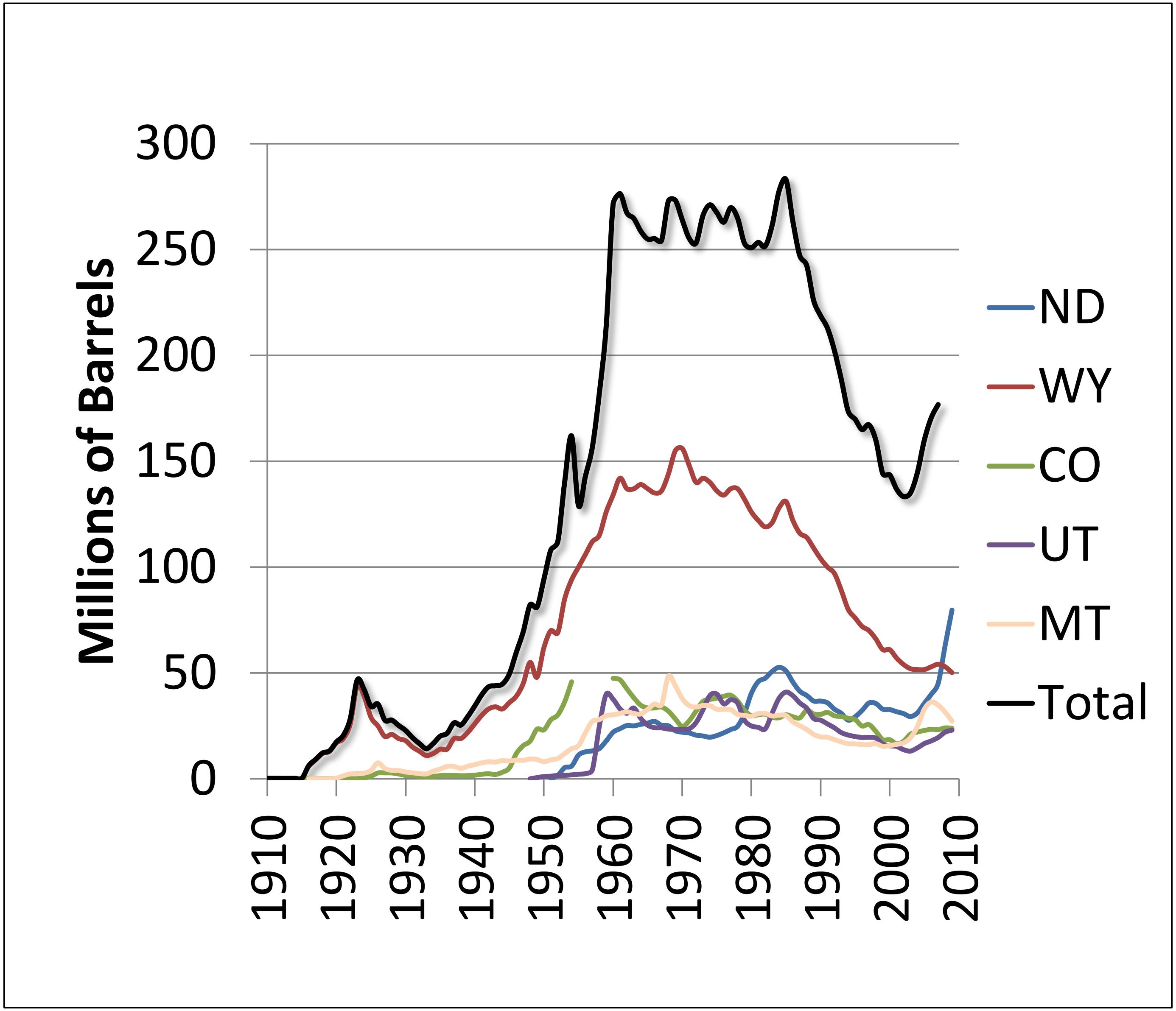
Completed the "Western Corridor" = Glacier + Bear Tooth + Big Horn

16%
n¢115
r¢165

Central Wyoming System segment is converted to natural gas and renamed "Pony Express", new pipe added from Casper to Wind River Basin

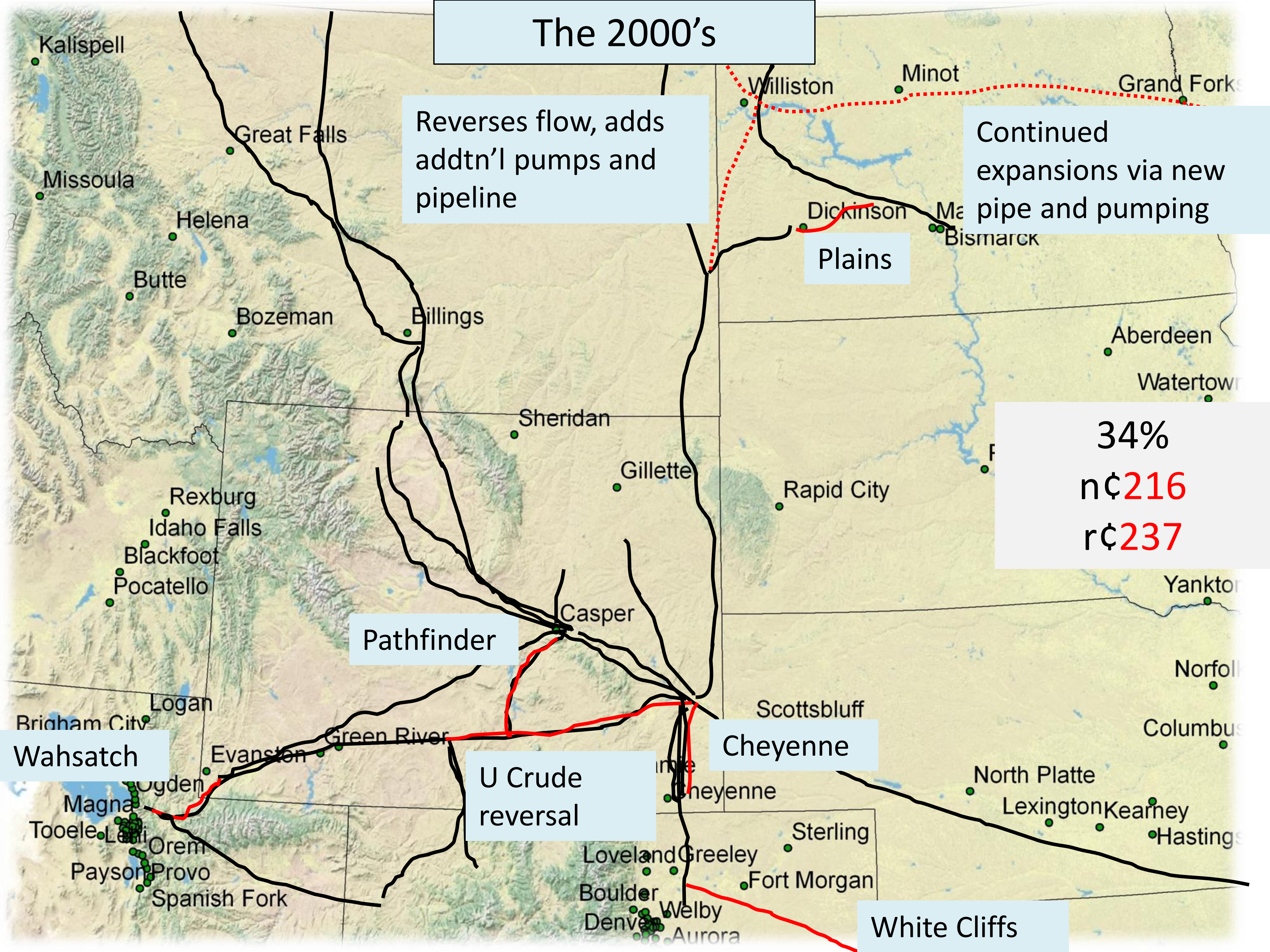


The 2000's



White Cliffs Pipeline, 12 inch, courtesy of SemGroup.

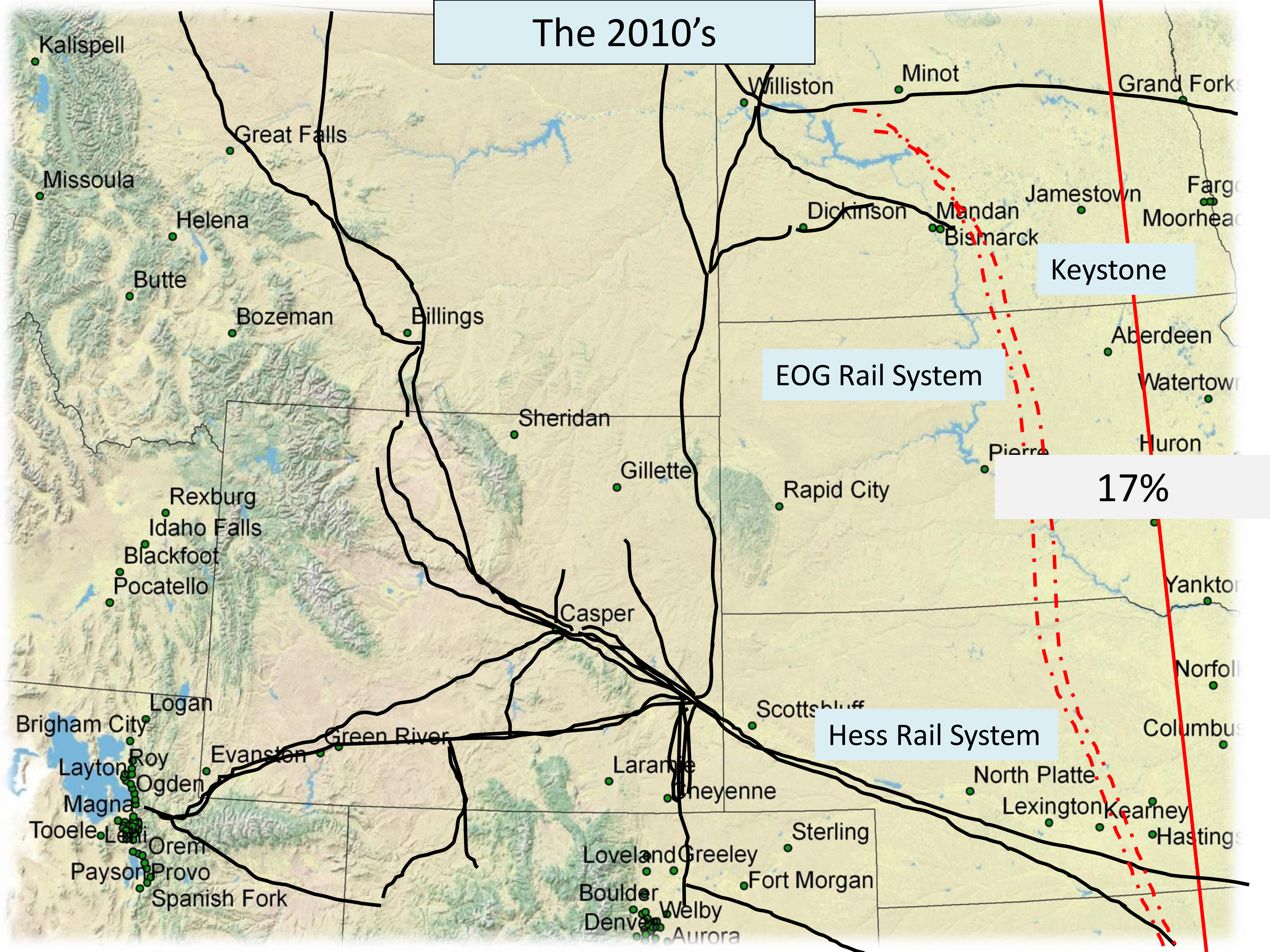
The 2000's


Reverses flow, adds addtn'l pumps and pipeline
Continued expansions via new pipe and pumping
Plains
34%
n¢216
r¢237
Pathfinder
Wahsatch
U Crude reversal
Cheyenne
White Cliffs
Kalispell
Great Falls
Missoula
Helena
Butte
Bozeman
Billings
Williston
Minot
Grand Forks
Dickinson
Bismarck
Aberdeen
Sheridan
Gillette
Rapid City
Rexburg
Idaho Falls
Blackfoot
Pocatello
Casper
Yankton
Norfolk
Logan
Brigham City
Evanston
Green River
Ogden
Magna
Tooele
Lehi
Orem
Payson
Provo
Spanish Fork
Scottsbluff
Columbus
North Platte
Lexington
Kearney
Hastings
Sterling
Loveland
Greeley
Fort Morgan
Boulder
Denver
Welby
Aurora

The 2010's

Wahsatch Pipeline, 16inch, courtesy of SLC Pipeline LLC (JV between Plains Pipeline and Holly Corp).

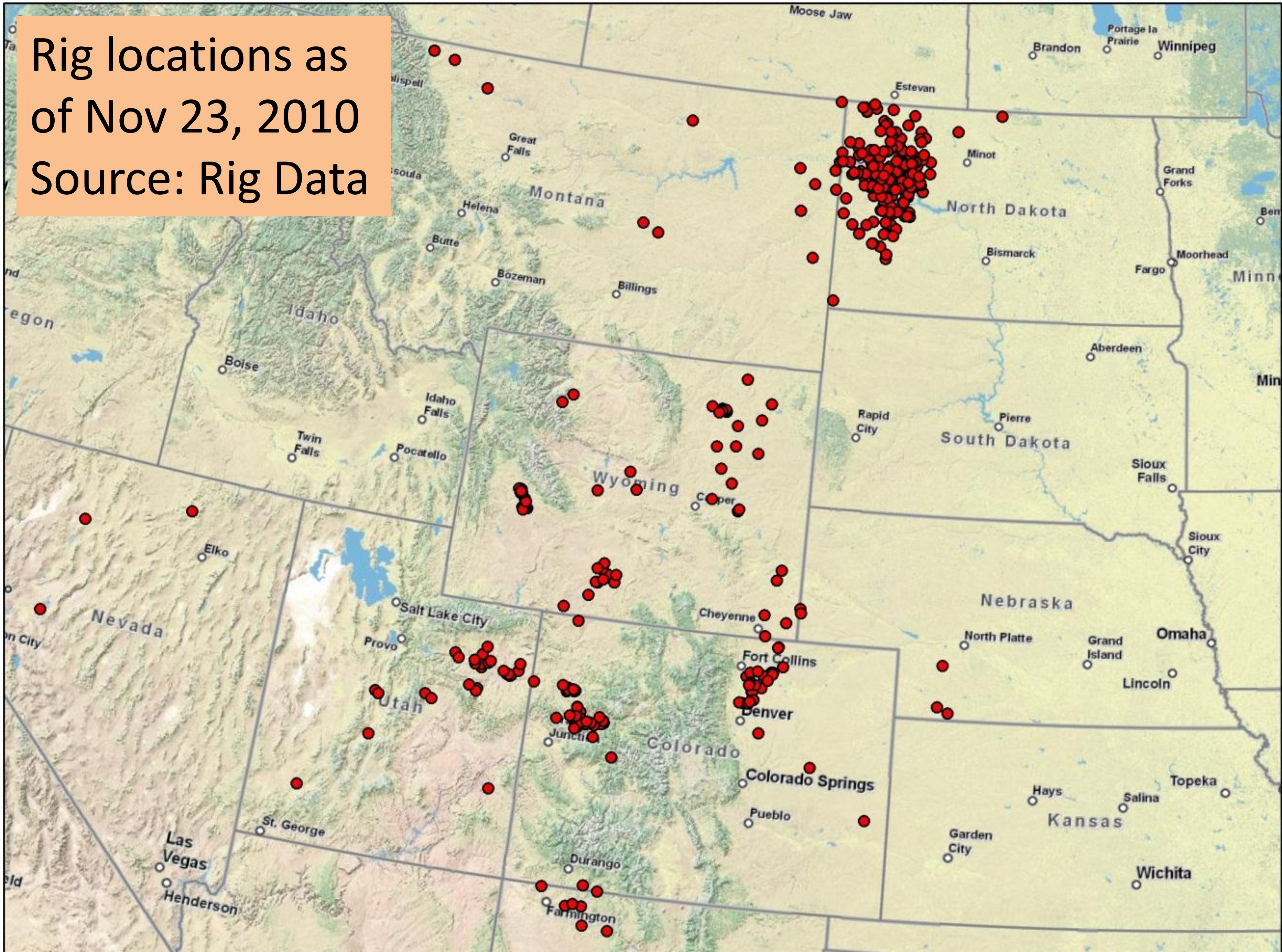
The 2010's


Keystone
EOG Rail System
17%
Hess Rail System
Kalispell
Great Falls
Missoula
Helena
Butte
Bozeman
Billings
Williston
Minot
Grand Fork
Dickinson
Mandan
Bismarck
Jamestown
Farg
Moorhea
Aberdeen
Watertow
Pierre
Huron
Sheridan
Gillette
Rapid City
Rexburg
Idaho Falls
Blackfoot
Pocatello
Casper
Yankto
Norfol
Logan
Brigham City
Roy
Layton
Ogden
Evanston
Green River
Laramie
Cheyenne
Columbu
North Platte
Lexington
Kearney
Hasting
Magna
Tooele
Lehi
Orem
Payson
Provo
Spanish Fork
Loveland
Greeley
Sterling
Fort Morgan
Boulder
Welby
Denver
Aurora

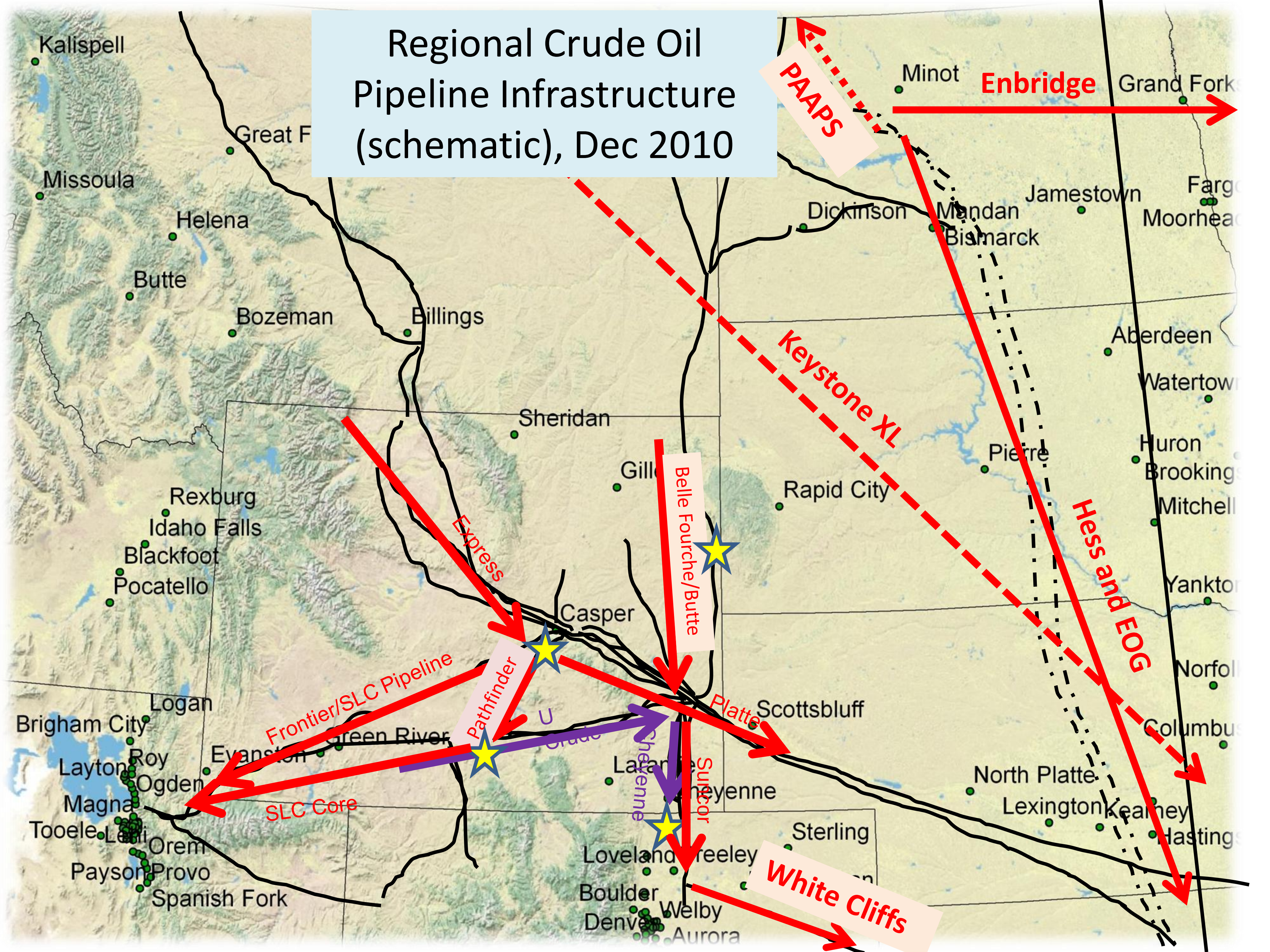
Observations

- Majority of crude oil infrastructure in the Rockies (by % increase) was built in the 1940’s and 50’s
- Nothing got done in the late 1960’s through the 70’s (more true than false)
- Incremental expansions take place as needed with a resurgence in late 1990’s – production driven
- When capacities waned or there was a shift in demand/supply, pipeline companies improvised: conversions, expedited or re-routed projects
- Rail is an export option for crude oil for competing export capacity

Rig locations as of Nov 23, 2010
Source: Rig Data



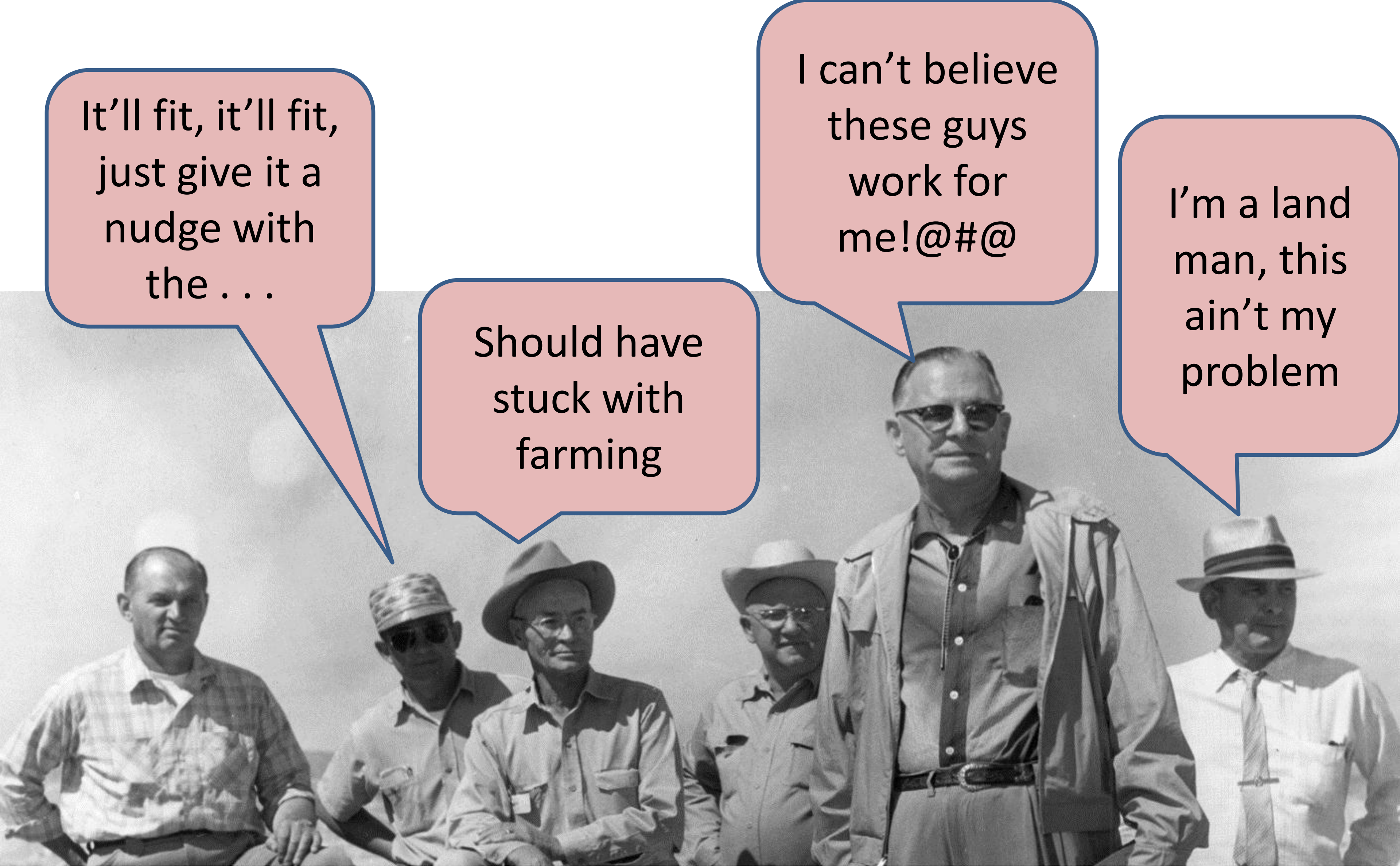
Regional Crude Oil Pipeline Infrastructure (schematic), Dec 2010



Regional proposals/expansions – 490,000 BOPD* within the next 3 yrs!

- Enbridge, proposed open season to add 145,000, closing Nov 30th
- Belle Fourche/Bridger Pipelines: "Baker 300", open season closed Nov 15th , 100,000 on KXL
- PAAPS "Bakken North Pipeline Project", proposed 50-75,000
- SemGroup/PAAPS "White Cliffs", 50,000 available via pumping expansion
- Hess, 60,000-120,000 via rail
- BNSF, [Bakken] goal via rail to reach 730,000!

* = 145 + 100 + 50 + 75 + 120. I did not factor-in the BNSF export goal.



www.wyopipeline.com