Reasonable Foreseeable Development Scenario

for the

Billings/Pompeys Pillar Resource Management Plan

Billings Field Office

Montana/Dakotas Bureau of Land Management

February 2010

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Summary

The Billings Resource Management Plan will guide management for the approximately 434,158 acres of federally managed surface and about 690,000 subsurface (oil and gas mineral estate) acres administered by the Billings Field Office (BiFO) in western Big Horn, Carbon, Golden Valley, Musselshell, Stillwater, Sweet Grass, Wheatland and Yellowstone counties. Conventional oil and natural gas occurrence and development potential ranges from Low to Moderate across the entire field office area. The occurrence potential for coal bed natural gas (CBNG), and gas from organic shales ranges from Low to High. Development potential for CBNG ranges from Low to Moderate; development potential for gas from organic shales ranges from Low to Moderate.

Introduction

The Billings Field Office is located in south-central Montana. There has been a long history of exploration and development within this area. The following information describes the historic activities associated with drilling in the area, with subsequent information, charts and graphs indicating the cumulative number of wells drilled, and notable dates.

<u>Drilling and Development History</u>

The first drilling in Montana occurred near the 'Cruse' oil seeps, in Carbon County, in about 1890. Drilling occurred along strike (northwest-southeast) to the Beartooth Mountain front. Only small volumes of low gravity oil were reportedly produced.

The Elk Basin area in Carbon County experienced early development, as an extension of the Wyoming portion of the field. The first drilling occurred about 1915; this activity pre-dated the Mineral Leasing Act of 1920. At that time, oil was developed as a placer mineral on mining claims located under the General Mining Act of 1872, as amended by the Petroleum Placers Act of 1897. Many of these petroleum placers went to patent (became private land).

Further drilling occurred as operators attempted to expand the known producing area along the axis of the Elk Basin anticline. The field limits were extended to the northwest, with the later discoveries at Elk Basin Northwest, Clarks Fork, the Clarks Fork North and Clarks Fork South fields. In the same time frame (1910s-1920s), exploration occurred at the Dry Creek Dome in central Carbon County. Natural gas was discovered there in 1919, and extended into Golden Dome in 1962.

In Big Horn County, the Soap Creek Oil Field was discovered in 1920, and expanded by new drilling as recent as 2005. The Hardin Gas Field was discovered in 1928, and expanded by new drilling into the 1930s, with the most recent well drilled in 1975.

Early prospecting for oil was concentrated around geologic structures that were exposed at the surface. These structures, often called "Sheepherder Anticlines", were believed to be indicators of potential oil reservoirs within subsurface structures. Most of the early exploration and development occurred in proximity to these exposed anticlines and domes. Many oil and gas fields are still identified by these surface structures (i.e., Golden Dome, Gage Dome, and Dean Dome). Often, the earliest wells drilled within these structures were not drilled deep enough, and did not achieve a discovery.

Many other anticlines were ‘breached’ by erosion that exposed the reservoir rock, leaving only stained or bleached rock as indications of the past presence of oil. This is the case on the east flank of Red Dome, in Carbon County. Here, the Triassic Chugwater Formation red beds have zones of sandstones that are gray; the oil, while it was in the rock, prevented the oxidation of the iron in the rock matrix and cement.

The first drilling in Musselshell County was not successful, but by 1920, oil was discovered in the Heath Lime, at Devil’s Basin field. By the end of 1921, oil had been discovered in the Soap Creek field in Big Horn County and the Lake Basin field in Stillwater County. Mosser Dome field in southwestern Yellowstone County opened in 1936.

In the 1940s, additional oil fields were discovered in Musselshell County, including Gage Dome, Ragged Point, Big Wall and Melstone. All were surface structures (‘Sheepherder Anticlines’), with the oil found in Mississippian carbonate rocks (Amsden, Kibbey, Heath and Tyler Formations). New fields were discovered in surface structures (Ivanhoe, Stensvad, Delphia, Hawk Creek, Hiawatha, Keg Coulee, Pole Creek, Mason Lake), and existing fields were expanded, into the 1960s. Similarly, exploration of the surface structure at Wolf Springs resulted in a oil discovery in Yellowstone County in 1955 and at Weed Creek in 1967.

The first gas production in Sweet Grass County occurred when the Six Shooter Dome field was discovered in 1947. First production in Golden Valley County occurred with the discovery of gas in the Big Coulee field, in 1948. Later that year, oil was discovered in Golden Valley’s Woman’s Pocket and Devil’s Pocket fields.

In 1953, the Ash Creek field in southern Big Horn County was discovered, with oil produced from the Upper Cretaceous Shannon Formation. The Mackay Dome and Roscoe Dome fields, in southern Stillwater and Carbon Counties, respectively, were discovered in the late 1950s. Both produce from Lower Cretaceous sandstones.

In the 1970s, the Rapelje gas field in Stillwater County was discovered.

Two oil price shocks in the 1970s resulted in a quadrupling of the price of oil over a four-year period, from around $3.00 per barrel in mid-1973, to over $12.00 per barrel in 1977. The Islamic Revolution in Iran in 1979 sent oil prices still higher, with the price peaking at over $38.00 per barrel in 1981.

The rapid increase in the price of oil resulted in a rush of new prospect generation. Even prospects that had a low probability of finding product were drilled. Conservation and new discoveries led to in an increased supply while demand was falling, resulting in a price collapse, with oil in Montana falling below $10.00 per barrel in early 1986. For the rest of the 1980s, the BLM allowed operators to leave their wells ‘shut in’ (in a non-producing status). This policy allowed operators to maintain their wells without having to operate them at an economic loss.

In 1992, the BLM terminated the above policy, and issued new regulations that provided for a reduced royalty rate for oil properties that averaged less than 15 barrels of oil per well per day (so-called 'stripper wells/properties). The royalty rate reduction (RRR) was intended to reduce operators' operating costs, and encourage the greatest ultimate recovery of oil. The BLM anticipated that operators would take advantage of this incentive and work over existing wells to restore or increase production within these properties. The RRR would be recalculated every year, and could fall further if the average production rate continued to decrease. The regulation was in effect for about 14 years, and terminated effective February 1, 2006 (when the oil price exceeded the threshold established in the regulation).

Federal Surface and Mineral Ownership within the Billings Field Office

Charts 1 and 2, below, provide the distribution of surface and mineral ownership, by county, within the Billings Field Office. Chart 3 presents surface and mineral ownership by Federal Agency. The data are from LR 2000, as of May 20, 2009.

Chart 1: Surface, Oil & Gas Mineral Ownership, and acres of O&G leases by County (All Surface Management Agencies)

County	Federal Surface Ownership	Federal Oil & Gas Mineral Ownership	O&G Leases	Leased Acres[2]	Percent of O&G Leased
Big Horn[1]	0.00	3,989.29	5	3,934.47	98.6%
Carbon	552,535.16	609,950.40	99	53,575.45	8.7%
Golden Valley	31,644.63	66,550.80	17	18,062.96	27.1%
Musselshell	100,458.12	140,922.31	79	56,641.02	40.2%
Stillwater	192,196.58	243,221.64	32	24,232.23	10.0%
Sweet Grass	297,308.04	356,378.33	25	19,772.71	5.5%
Wheatland	63,604.24	84,463.43	3	1,022.52	1.2%
Yellowstone	69,725.38	105,708.45	20	9,023.20	8.5%
Totals	**1,307,472.15**	**1,611,184.65**	**280**	**186,264.56**	**11.5%**

Footnotes
[1]Big Horn County includes only the portion within the Billings Field Office (west of R. 39 E.)
[2]Including leases sold at the Montana Competitive Oil and Gas Lease Sale held on January 27, 2009

Chart 2: Surface, Oil & Gas Mineral Ownership and acres of O&G leases by County, Managed by the Billings Field Office

County	BLM-Managed Surface	BLM-Managed Oil & Gas Mineral Ownership	O&G Leases	Leased Acres[2]	Percent of O&G Leased
Big Horn[1]	0.00	3,989.29	5	3,934.47	98.6%
Carbon	205,156.46	260,531.10	97	51,228.80	19.7%
Golden Valley	7,844.19	42,750.36	17	18,062.96	42.3%
Musselshell[3]	92,632.23	129,108.14	79[3]	56,401.02	43.7%
Stillwater	5,519.49	55,944.07	29	19,994.23	35.7%
Sweet Grass	15,833.58	73,584.22	25	19,772.71	26.8%
Wheatland	1,194.91	22,054.10	3	1,022.52	4.6%
Yellowstone	69,725.38	105,708.45	20	9,023.20	8.5%
Totals	**397,906.24**	**689,680.44**	**275**	**179,439.91**	**26.0%**

Footnotes
[1]Big Horn County includes only the portion within the Billings Field Office (west of R. 39 E.)
[2]Including leases sold at the Montana Competitive Oil and Gas Lease Sale held on January 27, 2009;
[3] There are two Federal O&G leases that include both BLM and FWS surface

Chart 3: Total Surface and Oil and Gas Mineral Ownership (in acres) by County, by Surface Management Agency

	BLM		FS		FWS		BIA		NPS	
County	**Surface**	**Oil & Gas Mineral Ownership**	**Surface**	**Oil & Gas Mineral Ownership**	**Surface**	**Oil & Gas Mineral Ownership**	**Surface**	**Oil & Gas Mineral Ownership**	**Surface**	**Oil & Gas Mineral Ownership**
Big Horn[1]	0	0	0	0	0	0	0	3,989.29		
Carbon	205,156.46	260,531.10	323,682.62	323,683.22					23,696.08	25,736.08
Golden Valley	7,844.19	42,750.36	23,800.44	23,800.44						
Musselshell	92,632.23	129,108.14	0	0	7,825.89	11,814.17				
Stillwater	5,519.49	55,944.07	185,604.65	185,885.13						
Sweet Grass	15,833.58	73,584.22	281,474.46	282,794.11	1,072.44	1,392.44				
Wheatland	1,194.91	22,054.10	62,409.33	62,409.33						
Yellowstone	69,725.38	105,708.45	0	0						
Totals	**397,906.24**	**689,680.44**	**876,971.50**	**878,572.23**	**8,898.33**	**13,206.61**	**0**	**3,989.29**	**23,696.08**	**25,736.08**

Footnotes
[1]Big Horn County includes only the portion within the Billings Field Office (west of R. 39 E.).

Description of Geology

Reservoirs, traps, source rocks, seals, hydrocarbon generation and migration

For a petroleum (oil and/or methane gas) occurrence to be economically viable, it must have:

- A thermally 'mature', organic material-rich source rock to produce the petroleum. The organic material may be the remains of marine plants (i.e., phytoplankton) or terrestrial plants. 'Maturity' is the measure of the pressure and temperature needed to alter the organic material trapped within the source rocks to petroleum or natural gases.

    - In an 'immature' source rock, the pressure and temperature have been too low (or occurred for too short a period of time) to 'cook' the organic material and generate oil and/or gas.

    - In a post-mature source rock, the organic material may have generated hydrocarbons, but pressure and/or temperature have been too high. Longer chain hydrocarbons may have broken down from petroleum to shorter chain hydrocarbon gases. The hydrocarbons may be oxidized to carbon and carbon dioxide, with the hydrogen and oxygen released as gases. Or, the organic material may be converted into other non-petroleum compounds.

- A trapping mechanism to prevent the petroleum from escaping the area. Traps are classified as:

    1. stratigraphic (the rock unit changes laterally to a non-porous unit such as shale or evaporates);

    2. structural (folds or faults, where the reservoir rock is capped by a non-porous rock unit that prevents the upward migration of the oil or gas, or the oil or gas cannot migrate across a fault plane);

    3. combination (where both stratigraphy and structure work together); or

    4. hydrologic (where movement of groundwater within the producing horizon has displaced the oil or gas from the crest of a structural trap).

    5. "continuous" (oil or gas remains within the source rock system due to low effective porosity and permeability and no adjacent secondary migration route). Continuous accumulations are described as a "geologically diverse group that includes coalbed methane, "tight" gas, basin-center gas, oil and gas in fractured shale and chalk, gas hydrates, and shallow biogenic gas" (Schmoker, 2005).

- A reservoir rock with sufficient porosity to hold a significant amount of petroleum or natural gases, and enough permeability to allow the petroleum or natural gases to flow within the rock.

- In hydrocarbon generation, the organic material in the source rocks undergoes both a chemical and phase change (from solid to liquid and/or gas). The decreased density and increased volume causes the source rock to fracture (creating 'expulsion fractures), and allows the migration of the oil and gas out of the source rock. The fluids may travel great distances through porous and permeable rock until their migration is impeded by some impermeable rock (for example, an evaporite bed, such as anhydrite or salt; a shale; or a limestone or sandstone with little porosity). In addition, fluid migration may be impeded by an impermeable geologic structure, such as a fault.

- Often, the source rock is also the reservoir rock, as in the 'continuous' accumulations, described above. The hydrocarbons generated during the maturation process are trapped within the source rock. In these cases, special drilling and well completion techniques may be required to allow the oil or gas to be economically recoverable. Self-sourcing reservoirs include coal beds; low porosity ('tight') organic shales; and interbedded shales and siltstones that may or may not have lateral continuity. In addition to the generation of hydrocarbons through heat and pressure, 'biogenic' gas may be generated by the metabolizing of organic material in the rock by certain bacteria.

Oil or gas reservoirs have been identified in strata from the Ordovician (Big Horn Dolomite, Red River Formation) to the Paleocene Fort Union Formation (coal bed natural gas). Trapping mechanisms within the BiFO are predominantly structural, often with some stratigraphic or hydrologic component.

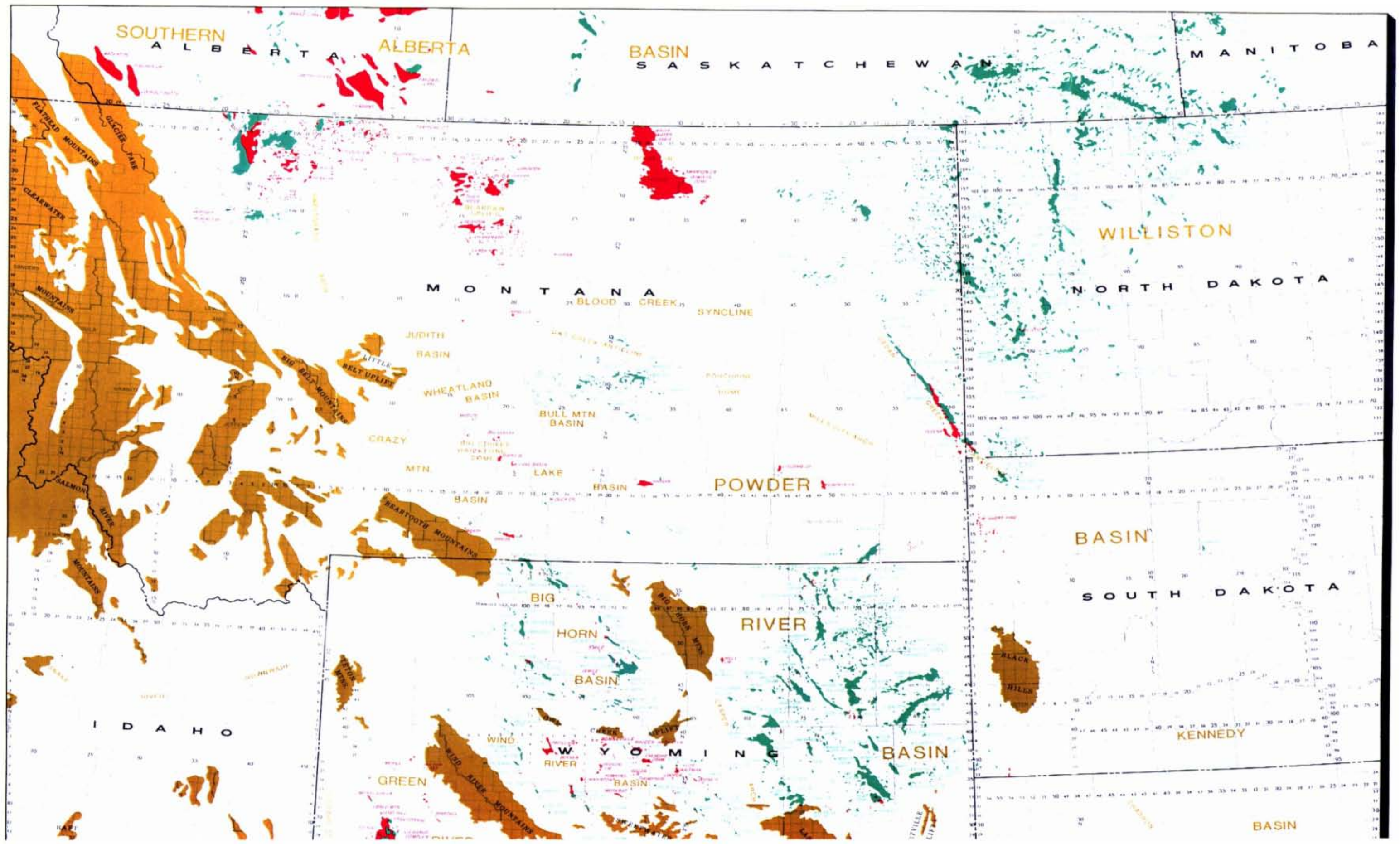
Source rocks within the BiFO include Paleozoic limestones and dolomites in the Madison, Lodgepole and Heath Formations, Cretaceous organic shales as well as Paleocene coal beds. The oils and gases produced from the various reservoirs may be associated with specific source rocks by their chemistry. All of the Paleozoic source rocks, and many of the Cretaceous source racks are 'mature' – the rocks have experienced sufficient temperature and pressure events to generate petroleum or natural gas. Some Cretaceous and Paleocene source rocks are still immature, but may have biogenic gas.

<u>Subsurface stratigraphy and structure</u>

The Billings Field Office is located within the Northern Great Plains Physiographic Province, where this province terminates to the west against the Northern Rocky Mountains. It is marked by a rolling to rugged topography, with occasionally deeply incised drainages and wide valleys for the major river systems. The lowlands are composed predominantly of sandstones and shales, with unconsolidated alluvium in the perennial and ephemeral stream channels. There are gravel terraces above the major river systems, representing past levels of these streams.

The uplands are composed of Paleozoic limestone and dolomite in the Big Snowy, Pryor and Big Horn Mountains. Precambrian metamorphic rocks crop out in the Beartooth Range, and Tertiary igneous rocks in the Crazy Mountains. All ranges except the Crazy Mountains arose as Laramide uplifts along reverse faults. The Crazy Mountains are composed of a varied series of Tertiary intrusive and extrusive igneous rocks, including stocks, sills, laccolith and dikes, dated at 51-49 million years.

Structurally, the eight-county area consists of the northwestern extension of the Big Horn Basin and the Big Horn Uplift, the southern portion of the Crazy Mountain Basin, the Bull Mountain Basin, and the southern portion of the Central Montana Uplift. All structures are of Laramide age.

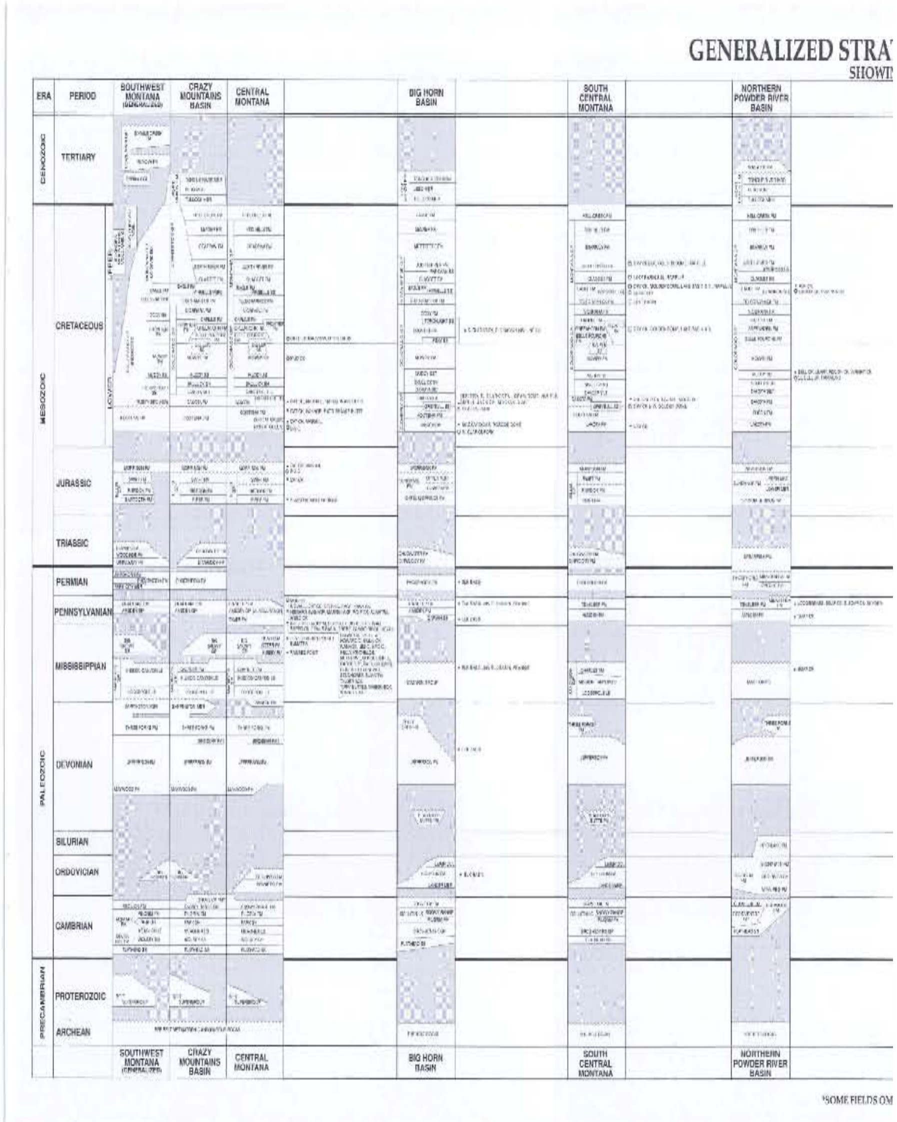


The Paleozoic and Mesozoic source rocks are all ‘mature’ -- organic matter has had the opportunity to generate hydrocarbons. A recent study conducted in the Crazy Mountains Basin (Johnson, 2005) has determined that there are nearly 30,000 feet of Phanerozoic sediments within the Basin. There is potential for development of ‘basin-centered gas’ in the deeper portions of the Basin.

Mesozoic and Paleocene coal beds have been able to generate coalbed natural gas (CBNG) including methane. The methane gas is adsorbed onto the surface of the coal, and remains adsorbed through hydrostatic pressure exerted by groundwater in the coal beds. Operators drill wells to reduce the pressure in the coal bed by producing groundwater present in the coal bed (‘dewatering’ the coals). This reduces the hydrostatic pressure and allows the CBNG to ‘desorb’ and flow along fractures in the coal to the producing wells. There do not appear to be any over-mature source rocks.

Stratigraphy

Strata within the field office area represent a nearly continuous sequence of deposition from Cambrian through the Paleocene, with the exception that Silurian-age rocks were either eroded or never deposited. In the Paleozoic, Cambrian through Mississippian rocks are composed mostly of limestone and dolomite. Pennsylvanian and Permian strata are predominantly clastic – sandstones and shales. Mesozoic and Cenozoic strata are predominantly sandstones and shales. Quaternary sediments are predominantly unconsolidated alluvial, fluvial, aeolian and glacial in origin. The sediments occur within floodplains, wetlands and in terraces on one or more levels above the major streams. Following is a Generalized Stratigraphic Correlation Chart for Montana. Several of the columns apply to the Billings Field Office.


GENERALIZED STRA
SHOWI
ERA
PERIOD
SOUTHWEST MONTANA (GENERALIZED)
CRAZY MOUNTAINS BASIN
CENTRAL MONTANA
BIG HORN BASIN
SOUTH CENTRAL MONTANA
NORTHERN POWDER RIVER BASIN
CENOZOIC
MESOZOIC
PALEOZOIC
PRECAMBRIAN
TERTIARY
CRETACEOUS
UPPER
LOWER
JURASSIC
TRIASSIC
PERMIAN
PENNSYLVANIAN
MISSISSIPPIAN
DEVONIAN
SILURIAN
ORDOVICIAN
CAMBRIAN
PROTEROZOIC
ARCHEAN
SOME FIELDS OM

Structure

South-central Montana has a dominant northwest-southeast 'grain' with most structures having axes trending parallel to this grain. Typical examples of these structures include the Elk Basin Anticline, the Lake Basin Fault Zone and the Nye-Bowler Lineament. The Beartooth Mountains are bounded on the north by a fault that trends northwest-southeast.

The Lake Basin Fault Zone is a series of *en echelon* faults that strike northeast to southwest, but occur along a northwest to southeast trend. Several oil and gas reservoirs have been found within the structure, including Lake Basin, Lake Basin North, and Little Basin fields.

Similarly, the Nye-Bowler Lineament extends across the southern portion of the field office. It is a continuous zone of structural disturbance extending for a distance of at least 115 miles from Livingston to the Pryor Mountains (Foose, 1961). Across the northern part of the Big Horn Basin, the lineament is featured by numerous northeastward-trending *en-echelon* faults. In its eastern extent, it separates the northern and southern portions of the Pryor Mountains. Roscoe Dome, McKay Dome, Dean Dome and Dry Creek/Golden Dome are all small structurally-trapped oil fields located along the Lineament (Wise, 2000).

The Central Montana Uplift has two main prospective areas. In Golden Valley and western Musselshell Counties, production has been discovered in Mississippian and Pennsylvanian (Madison and Amsden Formations) carbonates associated with surface-exposed structures. In eastern Musselshell County, production has been discovered in Pennsylvanian carbonates and sandstones of the Heath and Tyler Formations.

The Tyler Formation is fluvial sandstone deposited within the Central Montana Trough (also described as the Big Snowy Trough). This structural feature extends from the Antler Foreland Basin in western Montana, northeast to the Williston Basin of eastern Montana and western North Dakota (Precht and Shepard, 1989). It has been described as an 'aulocogen' – a failed 'arm' of the mid-Proterozoic rifting during the development of the Belt Basin.

Many of the structures are exposed at the surface and served as early exploration targets. The first drillers would locate their wells along the structural axis of a fold with the expectation of discovering oil in a deeper horizon. Often, several horizons within the structure may be charged with oil or gas, as in the Elk Basin field.

Past and Present Fluid Mineral Exploration Activity

Geophysical and Geochemical Surveys

Geophysical exploration has been concentrated in areas in proximity to existing production. In eastern Musselshell County, exploration has attempted to identify the orientation and extent of Tyler Formation channel sandstones. Elsewhere, seismic exploration has been conducted to identify potential structural traps.

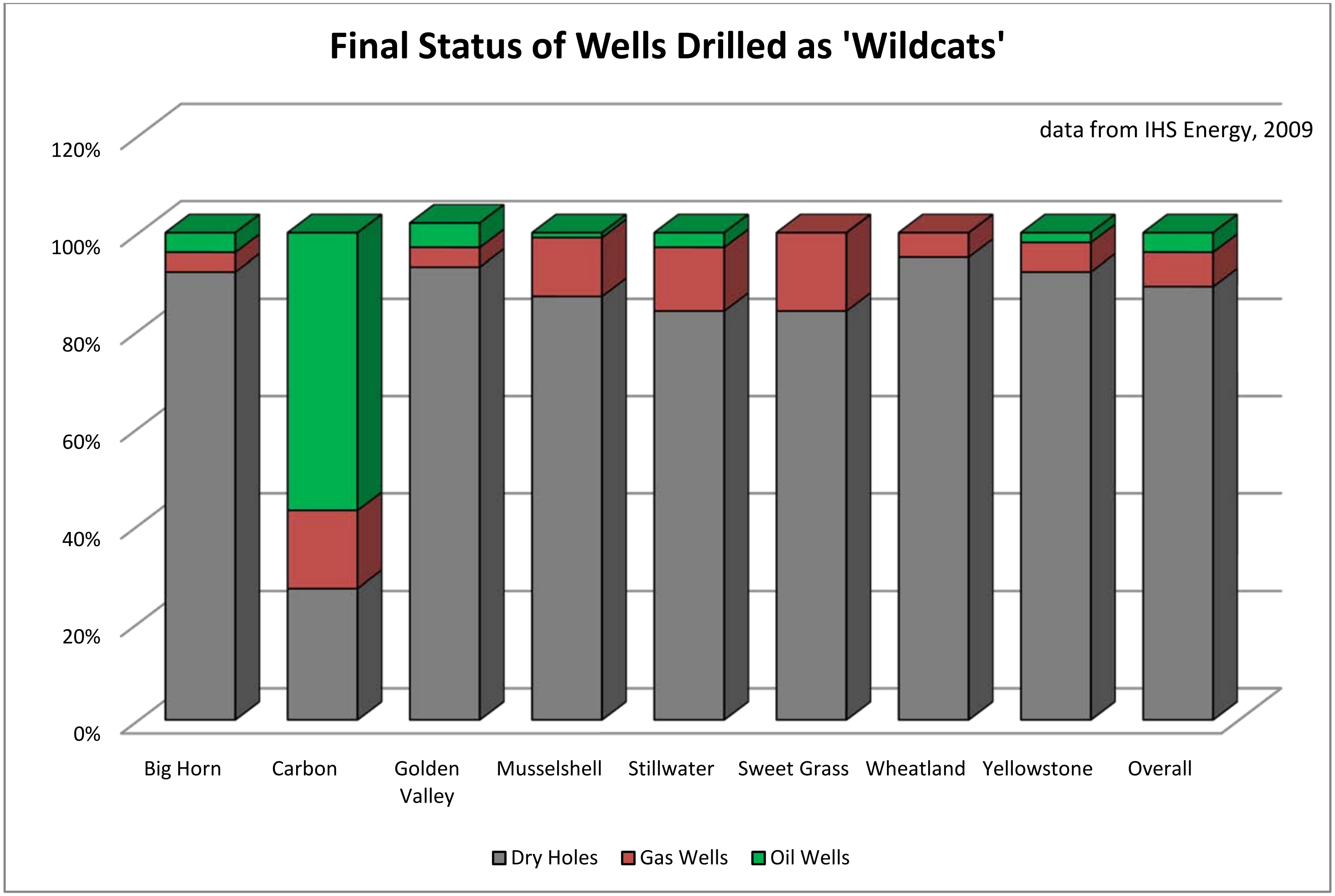
In the last 15 years, the BiFO has permitted 10 geophysical exploration operations. Most of the operations crossed only small areas of public lands (40 to 560 acres), and may have been focused on a single prospect or extending production in an oil or gas field. One operation extended across a wide area of southern Carbon County, involving nearly 13,800 acres of public lands.

Exploratory drilling and success rates

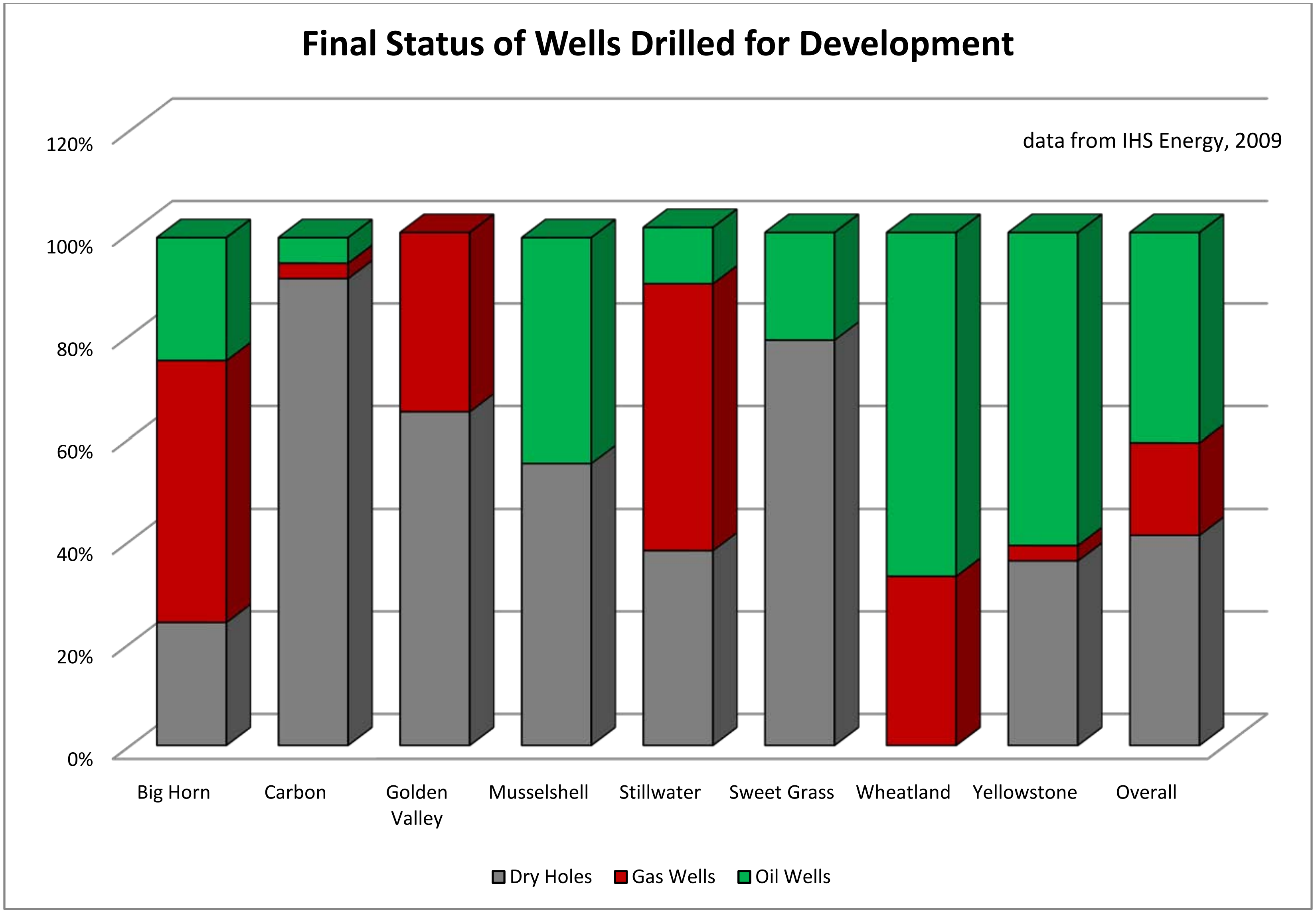
As stated earlier, there has been a long history of exploration and development in south-central Montana, with the first drilling occurring around 1890. Most of the drilling activity occurred during the decades of the 1950s through the 1980s. Altogether, nearly 3,800 oil and gas wells have been drilled in the eight county area (excluding the coal bed natural gas play in eastern Big Horn County).

Most of the oil and gas reservoirs discovered within south-central Montana are small features, no more than one to two square miles in extent. For this reason, drilling success rates are poor, and production volumes from any discoveries are not large.

A common estimate for the success rate for wildcat drilling is 10-20%, with development wells having a success rate of about 70%. Within the BiFO, the success rate for wildcat wells is only 11% (216 oil or gas wells of 1,990 wildcat wells drilled).



The success rate for development wells (including wells drilled as ‘service’ – for injection or disposal purposes), is about 59 percent within the area of the Billings Field Office.



Final Status of Wells Drilled for Development
data from IHS Energy, 2009
120%
100%
80%
60%
40%
20%
0%
Big Horn
Carbon
Golden Valley
Musselshell
Stillwater
Sweet Grass
Wheatland
Yellowstone
Overall
Dry Holes
Gas Wells
Oil Wells

Altogether, 1,250 wells (both wildcat and development) produced at least some oil or gas, a success rate of 34%. Many of the gas wells were completed for domestic use only, and did not achieve commercial production rates

In general, the BiFO has a low probability for 'serendipitous' oil or gas discoveries – finding hydrocarbons in horizons other than the initial target zone. Nevertheless, the Elk Basin field is productive in several horizons, including the Ordovician Big Horn Dolomite; the Mississippian Madison Formation, the Pennsylvanian Amsden, Tensleep and Embar Formations, and the Lower Cretaceous Frontier Formation. Additionally, several of the natural gas fields within the Central Montana Uplift produce from one or more sands in the Upper Cretaceous (Eagle, Virgelle, Judith River, and Claggett).

Musselshell County especially has a low success rate (about 30%), because operators were looking to extend production in the Tyler channel sandstones by drillings offsets. It often takes 2-3 wells to establish the Tyler sand trend in these fluvial reservoirs.

While many of the factors described in Appendix 2 above apply throughout the western U.S.A., several clearly do not apply to the BiFO. For example, there has not been a measurable increase in the success rate of wells drilled in south-central Montana.

New field and reservoir discoveries

General

If a new play or field is discovered, the well operator will act quickly to review the geologic analysis used to identify the prospect. The operator will analyze logs taken from the well, and any other data, to either confirm or revise the original geological interpretation. At that point, the operator may be able to determine where future drilling should occur to fully define the limits of the prospect. The operator may also apply for an Order from the MBOGC to establish field rules (well spacing density and 'setbacks' from spacing unit boundaries) for the geological horizon(s) that are known to produce oil or gas. When Federal minerals are included in the application area, the BLM is also involved.

There have been few new field discoveries within the last 25 years, and few extensions of existing fields through step-out drilling or deeper drilling. In fact, of 73 named fields, 26 fields (over one-third) are currently inactive (MBOGC, 2009).

Crazy Mountains Basin

The one new play within the Billings Field Office is in the Crazy Mountain Basin in Sweet Grass and Park Counties (Park County is located directly west of the Billings Field Office), with exploration for oil or gas in organic shales. These organic shales are generally continuous, stratigraphic traps, though there may be local patterns of natural fractures that enhance the low permeability in the shales. Development of the gas requires fracturing of the shales to increase permeability. This is achieved by injection of water and/or other chemicals into the formation at high pressure, which generates fractures. A proppant (such as sand) is then injected into the formation to keep the fractures from closing when the pressure is reduced.

Several operators are involved in the current exploration. The Bill Barrett Corporation (Barrett) has made several apparent gas or oil discoveries in its 'Montana Overthrust-Circus' prospect in northwestern Park County. The wells recovered gas from the Lower Cretaceous Cody Shale Formation. All of the wells are shut in pending connection to a pipeline. Barrett is currently evaluating the success of its program in light of its high drilling and completion costs, and the recent lower prices for natural gas. A recent article in the Oil and Gas Journal (OGJ, 2009) stated that Barrett encountered more complex geology than anticipated. The article states that Barrett had noncommercial gas flows up to 1.1 million cubic feet per day, oil flows up to 117 barrels per day, and large quantities of water.

Devon Energy Production Company (Devon) has completed one well in its exploration program in Sweet Grass County. The Cremer #2-24 well (T. 4 N., R. 14 E., sec. 24) was drilled to the Upper Cretaceous Mowry Formation. To date, Devon has apparently discovered natural gas in the Judith River Formation (not an organic shale). The well has a reported initial potential of 1,080 MCF of gas per day, with 1,267 barrels of water. This discovery is about 20 miles west of production in the Six Shooter Dome field. As of June, 2009, Devon had five additional approved drilling locations in the two counties, while Barrett had six undrilled locations.

Coal Bed Natural Gas

Currently, there is no coal bed natural gas (CBNG) production within the Billings Field Office. The CBNG is generated in the coal deposit by both thermogenic (heat-driven) and biogenic (microbe-driven) conditions. The CBNG is trapped within the coal by the pressure of hydrostatic groundwater. Releasing the pressure by producing the groundwater from the coal bed aquifers liberates the CBNG, allowing it to flow. The extent of the CBNG resource is dependent upon the coal type (rank) and tonnage. The location of the coal resources determines the location of the CBNG potential.

A paper by Nuccio and Finn (1998) suggests that there is "fair to good" potential for biogenic gas generation in Fort Union coals in the Big Horn Basin. Roberts (1999) states that "Perhaps the single most limiting factor reducing the potential for coal-bed methane resources in the Fort Union Formation is the apparent lack of thick, persistent coal in much of the [Big Horn] basin."

The BLM has identified potential for production of CBNG from Upper Cretaceous and Paleocene coal beds in the Bull Mountain Basin and the Big Horn Basin.

There are five known coal fields within the Billings Field Office, each described below. All of the coals are of sub-bituminous to bituminous rank. Adsorbed gas would range from 200 to 450 cubic feet per ton of coal (Flores, 1998).

The Bridger/Fromberg/Joliet coal field extends from southwest of Bridger, Montana, north to the towns of Fromberg and Joliet (Washburne, 1907). The coals are in the Upper Cretaceous Eagle Formation. Surface and underground mining occurred from the 1880s to the 1930s. The coals dip to the west-southwest. A fault striking northeast-southwest offsets the coals, and effectively isolates the coals near Bridger from the Fromberg-Joliet coals. There are three distinct beds, separated by shale or 'bone' partings. The thickest coal bed, at about four feet, occurs west of Bridger. There may be CBNG potential where the coals are at a greater depth, and the CBNG may still be under hydrostatic pressure. Coals near the mine face have probably been 'degassed'. A sample of the coal in proximity to Fromberg tested at 10,235 Btu per pound. Near Bridger, the coal tested at 10,037 Btu per pound (Washburne, 1907).

The Bull Mountain coal field is located south and east of the town of Roundup, in Musselshell and Yellowstone Counties. The coal field is located within the Bull Mountain Basin, a roughly elliptical area located in southern Musselshell and northern Yellowstone Counties.

The coals are in the Tongue River member of the Paleocene Fort Union Formation (Woolsey, 1917). There are 27 named coal beds in the Bull Mountain field, with the oldest beds cropping out on the flanks of the Basin, and the younger coals toward the center of the Basin. In the early to mid 20th Century, several of the coal beds were extensively developed via underground mining, especially in proximity to the town of Roundup.

The Mammoth and Rehder coal beds occur towards the top of the Tongue River member. They are distinct coals separated by a thick parting that thins to the southeast. Together, they form the thickest and most extensive coals in the Basin, resulting in a single 13 foot bed of coal.

In the 1950's, two small surface mines were opened in the Mammoth-Rehder coal bed. In the 1990s, an underground mine began to produce Mammoth-Rehder coal. Coal samples of the Mammoth-Rehder bed tested at 10,120 Btu per pound on an as received basis.

In the early 1900s, a small mine was opened in the stratigraphically lower McCleary coal. A sample of this coal bed tested at 9,270 Btu per pound (Woolsey, 1917).

Any CBNG in proximity to the mine faces likely has vented to the atmosphere. There should be CBNG potential in the deeper portions of the Bull Mountain Basin, and in coals that were not mined because of their thinness or depth.

The Red Lodge-Bearcreek coal field is located in southern Carbon County, near the town of Red Lodge. The coals are in the Paleocene Fort Union Formation, and have the highest heating values -- 11,194 Btu -- of any coals within the Billings Field Office (Woodruff, 1907). There are nine known coal beds. Extensive underground mining took place, with 16 known underground mines operating between the 1880s through the 1940s. There was a small strip mine near the town of Bearcreek. Methane in these coals likely caused the tragic Smith Mine fire in 1943. It is probable that past mining has allowed the CBNG in proximity to mine workings to escape to the atmosphere. West and south of the mining, where the coals are deeper and less likely to have been 'degassed', Rawlins (1986) identified six beds of at least four feet in thickness, with an aggregate of 700 million tons of coal. In 1991, Florentine Exploration & Production Company drilled four wells to test the CBNG potential. These wells were all plugged and abandoned. There were no reported gas shows.

The Silvertip coal field straddles the Montana-Wyoming state line, in proximity to the Elk Basin oil field (Washburne, 1907). The coal is in the Eagle Formation. Only limited mining occurred, and little is known about the coal thickness or quality. There is an estimated 17.9 million tons of coal (in both the Montana and Wyoming portions) to a depth of 3,000 feet (Berryhill et al, 1950).

The Stillwater coal field is located in southern Stillwater County, near the town of Beehive. The coal is in the Eagle Formation. Only limited mining occurred, and little is known about the coal thickness. A coal sample tested at 10,680 Btu per pound (Calvert, 1916). There is no information on potential coal resources.

The BLM does not anticipate that CBNG exploration and development in the Billings Field Office would have the same intensity as does the CBNG development in the Powder River Basin. Compared to the Powder River Basin, the coals in the above-described fields are:

- thinner;
- higher rank, with likely higher adsorbed gas levels;
- more deeply buried;
- drilling and development likely would have a lower well density;
- there would likely be a single well per spacing unit (no thick, stacked coals);
- the coals are generally too deep below the surface to supply groundwater for most domestic and agricultural purposes; and
- groundwater within the coals likely has higher salinities and would not be suitable for domestic or agricultural purposes.

In contrast to the Powder River Basin CBNG development, the BLM expects that produced water volumes associated with CBNG development within the Billings Field Office would be similar to conventional oil and gas development, having lower volumes and higher salinities. It is probable that the produced water would be reinjected into a subsurface aquifer that already has high salinities, or allowed to evaporate in lined pits.

The Preferred Alternative (H) developed for the October, 2008, Final Supplement to the Montana Statewide Oil and Gas Environmental Impact Statement and Proposed Amendment of the Powder River and Billings Resource Management Plans, considered the phased development of the CBNG and conventional oil and gas resources.

Drainage protection

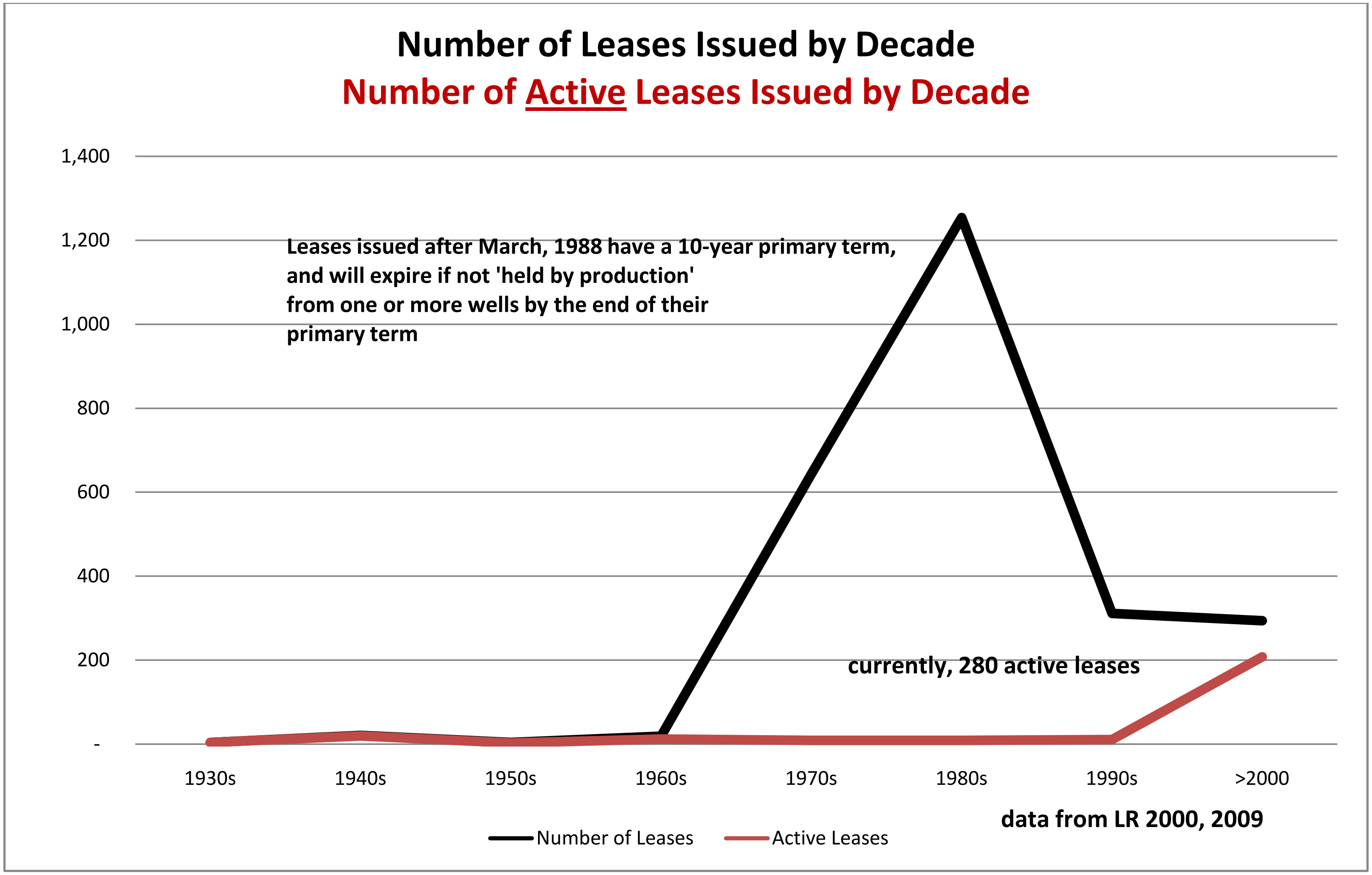
Producing oil and gas wells may cause 'drainage' (migration of the oil and gas from adjacent lands toward the borehole). Drainage will decrease the potential recovery of oil and gas reserves from those adjacent lands and thus result in loss of production and royalty revenues for the well operator and landowners. Ideally, drainage is avoided by concurrent development of surrounding lands. When the lands are not under an oil and gas lease, drainage may be resolved by leasing the minerals, and requiring the lessee to drill a 'protection' well, which will capture the oil or gas and prevent further drainage.

Often, drainage situations may be resolved by a 'pooling' or communitization agreement. By protecting Federal lands from drainage, the BLM may help to insure timely and more efficient management of the producing reservoir, and increase total recovery of oil and gas. The BLM may only require the drilling of a protection well if it can demonstrate that the protection well would be economic – that the revenue generated from the oil or gas production exceeds the costs of drilling and operating the well and allows an economic rate of return to the operator.

Past and Present Fluid Mineral Development Activity

Leasing, unit descriptions, spacing requirements, well locations by class and type

The number of active Federal oil and gas leases is always in flux. Leases expire if they are not developed, and new leases may be sold at the periodic lease sales. Historically, over 2,400 individual leases have been issued within the BiFO. Most of the leases expired when they reached the end of their lease term, or were terminated early for the lessee's failure to pay rentals. The same Federal lands may have been leased many times over the last 70-80 years.



As of June 1, 2009, there were 280 total leases, encompassing over 186,000 acres of Federal minerals leased for oil and gas within the eight county BiFO.

Most of the active leases are relatively new, issued since 2000. In fact, 26 of the 280 leases were issued in 2009 alone, and 208 during the decade 0f 2000-2009. All leases issued since March, 1988 have 10-year primary terms, and will expire if there is no drilling activity and/or production is not established within the leases. There are many older leases, including one active lease issued in 1939.

The older leases are 'held by production' from one or more producing wells. Leases that are held by production remain in effect as long as there is production within the lease.

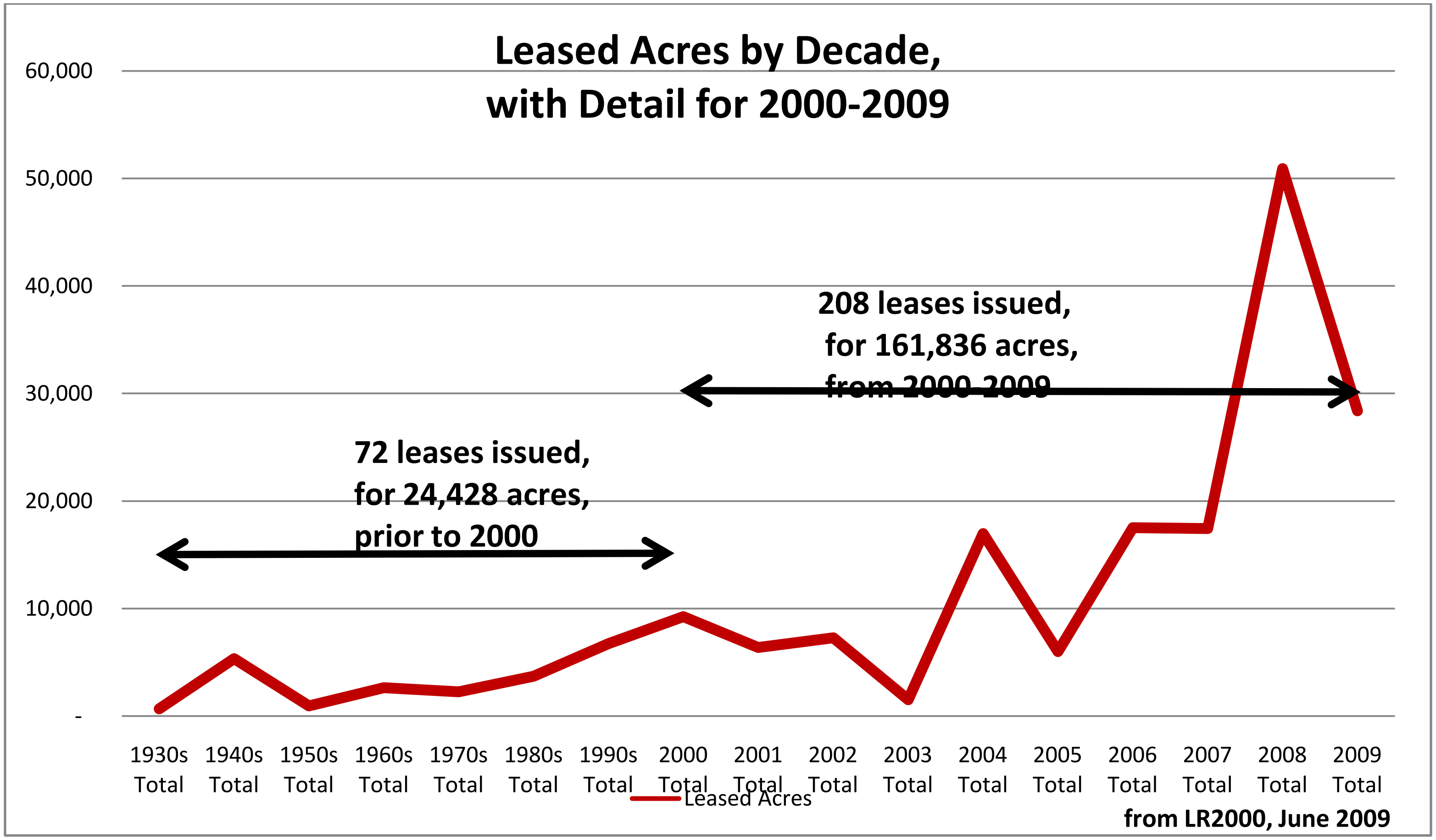


Chart 4: Surface, Oil & Gas Mineral Ownership and acres of O&G leases by County, Managed by the Billings Field Office

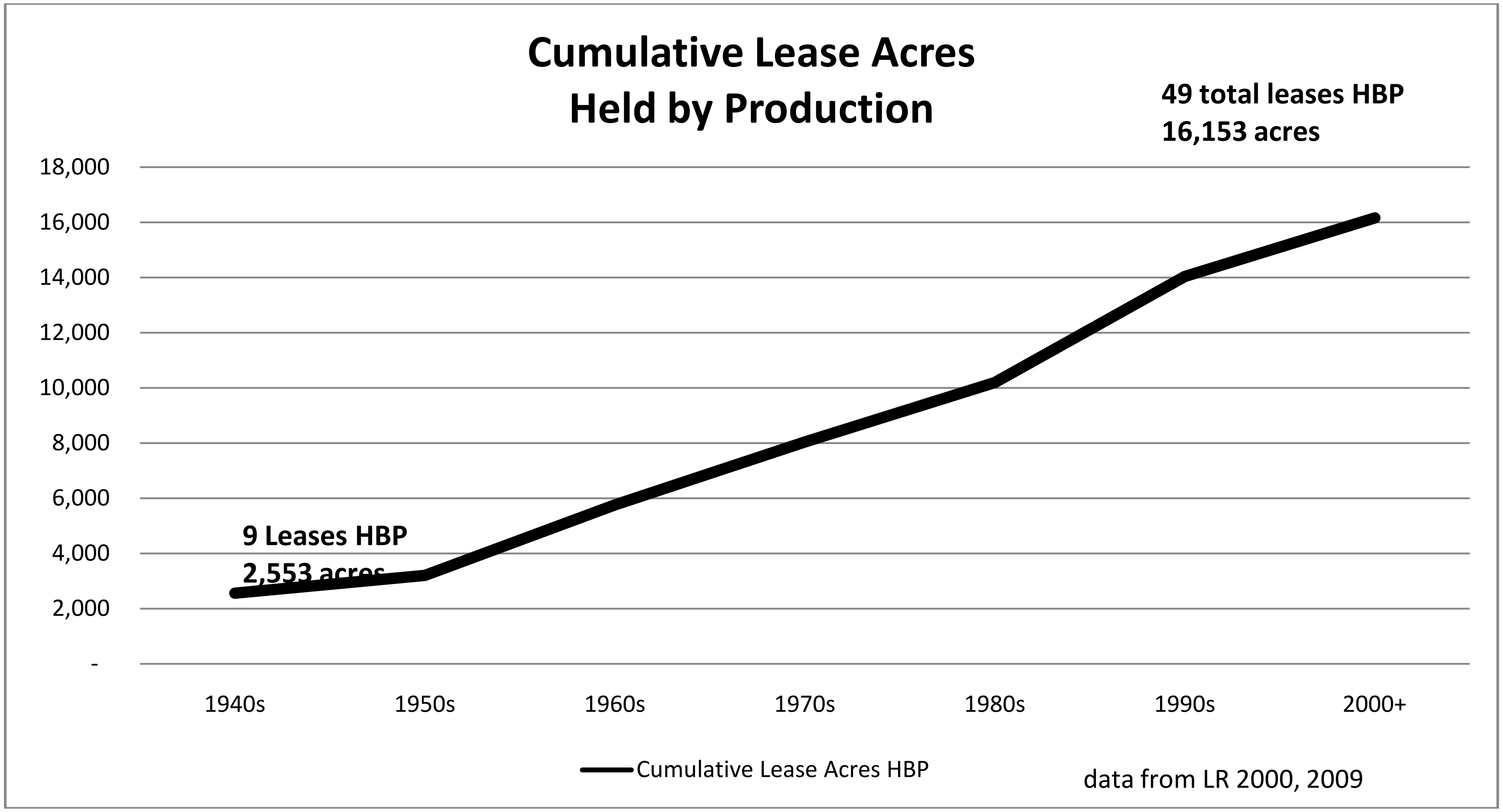
County	BLM-Managed Surface	BLM-Managed Oil & Gas Mineral Ownership	O&G Leases	Leased Acres[2]	Percent of O&G Leased
Big Horn[1]	0.00	3,989.29	5	3,934.47	98.6%
Carbon	205,156.46	260,531.10	97	51,228.80	19.7%
Golden Valley	7,844.19	42,750.36	17	18,062.96	42.3%
Musselshell[3]	92,632.23	129,108.14	79[3]	56,401.02	43.7%
Stillwater	5,519.49	55,944.07	29	19,994.23	35.7%
Sweet Grass	15,833.58	73,584.22	25	19,772.71	26.8%
Wheatland	1,194.91	22,054.10	3	1,022.52	4.6%
Yellowstone	69,725.38	105,708.45	20	9,023.20	8.5%
Totals	**397,906.24**	**689,680.44**	**275**	**179,439.91**	**26.0%**

Footnotes
[1]Big Horn County includes only the portion within the Billings Field Office (west of R. 39 E.)
[2]Including leases sold at the Montana Competitive Oil and Gas Lease Sale held on January 27, 2009;
[3] There are two Federal O&G leases that include both BLM and FWS surface

A few of the leases are located on lands managed by another surface management agency. Chart 4, above, identifies the leased acres underlying Federal lands managed by the BLM/Billings Field Office.

Federal oil and gas leases may be held beyond their primary term by 'actual' or 'allocated' production. Leases held by *actual* production have a producing well located physically within the lease boundary. In the case of *allocated* production, the leases may be committed to communitization (or 'pooling' agreements) or unit agreements (including 'participating areas' of exploratory units). A portion of the production from the communitization agreement (CA), unit participating area or unit agreement is allocated to the Federal lease. Leases that are held by allocated production remain in effect as long as there is production allocated to the lease.

As of June, 2009, 49 Federal oil and gas leases were held by production, totaling 16,153 acres (see following chart). This represents less than 20% of the 280 total leases, and about 9% of the leased acres. In addition, it represents only one percent of the more than 1.6 million acres of Federal mineral estate in the eight counties.



Communitization Agreements

Communitization Agreements (CAs) may be authorized when a Federal oil and gas lease cannot be independently developed and operated in conformity with an established well-spacing or well-development program. The BLM may include unleased Federal minerals within a CA to prevent drainage from occurring. Communitization of tracts with different ownership may be required in order to form a drilling unit that conforms to acceptable spacing patterns established by a MBOGC or BLM order. In addition, communitization is required when the logical spacing for a well includes both unitized and non-unitized lands. Communitized tracts share in production based upon their surface acreage relative to the total CA acreage.

As of August 01, 2009, there were 15 active CAs located within the BiFO, encompassing approximately 3,654 acres. Most of the CAs are for 160 to 320 acres.

Exploratory Units

An 'exploratory unit agreement' may be established by an operator who has outlined a prospect he wants to test for the presence of economic quantities of oil and gas. While the operator may have a specific horizon he plans to test, in most cases all horizons are included within the unit. In an exploratory unit agreement, the unit operator has specific drilling location and depth commitments to test his prospect.

Spacing rules may be waived within exploratory units. Because unitized land is treated as a single large 'lease', wells may be placed in the most favorable location without regard to correlative rights. If oil or gas is discovered in paying quantities, production revenue is allocated to the leases involved in accordance with the terms of the unit agreement. If oil or gas is not discovered in paying quantities, any production revenue is allocated to the lease within which the well is located, and the unit will eventually terminate.

There is one exploratory unit within the BiFO. The Elk Basin Unit (EBU) is operated by Encore Energy Partners Operating, LLC (Encore). It is located predominantly within Wyoming, with only a small portion in Carbon County, Montana. The EBU is administered by the Wyoming Reservoir Management Group (RMG) in Casper. The unit has several active 'participating areas' (distinct oil or gas reservoirs), each managed to maximize their recoverable reserves. Though the EBU is an exploratory unit, the Embar-Tensleep Participating Area is an enhanced recovery operation, with the operator recovering more oil through crestal injection of natural gas. Overall, it is the field with the most production (both oil and gas) within the BiFO. Recently, Encore entered into a merger agreement with Denbury Resources, Inc.

Denbury is a leader in the injection of CO_2 for enhanced oil [tertiary] recovery. It is likely that Denbury's intent is to initiate tertiary recovery in the field as a means of extending the field life and increasing overall oil recovery. This would require the construction of a CO_2 pipeline into the Elk Basin area and the drilling of new injection wells, or the conversion of existing wells for CO_2 injection.

New exploratory units could be established at any time in the future in response to evolving geological interpretations, improvements in exploration, drilling, and production technologies, or other factors.

Secondary Units

Primary production of oil may recovery only 15-20 percent of the oil within the reservoir (whereas gas wells may recover as much as 80-90 percent of the gas in place). Reservoir pressure and production volumes decrease as the wells are produced. Often, the per cent of water produced with the oil increases as the volume of oil decreases, which further harms the well and field economics.

It is often preferable to invest in secondary recovery projects over exploratory drilling. In these cases, the operator already knows the extent and quality of the reservoir, and has an infrastructure in place for producing and transporting the oil. Water is injected with the intent of restoring reservoir pressure, and displacing the oil toward production wells. Injection can increase oil production, and extend the life of the field. It may more than double the volume of oil recovered from the reservoir through primary recovery.

If the proposed unit includes Federal minerals, the BLM must approve the unit area and administers its planned development. When there are no Federal minerals, or only a small proportion of Federal minerals included within the unit, the MBOGC administers the unit.

There are seven BLM-administered secondary recovery units overall, one in Carbon County, five in Musselshell County and one in Yellowstone County. The Miles City Field Office administers six of the Federal units. The RMG administers the Frannie Unit. Note that there is no current production in the Montana portion of the Frannie Unit; all of the producing wells are in Wyoming.

Following is a list of active Federal and State administered secondary recovery units within the BiFO, as of the end of 2008:

Administrative Agency	Unit Name	County	Current Operator	Horizon
MBOGC	Big Wall Creek	Musselshell	Citation Oil & Gas Corp	Tyler
BLM- Miles City FO	Buttes Keg Coulee Tyler “C”	Musselshell	Xeric O&G Corp	Tyler “C”
MBOGC	Elk Basin Northwest	Carbon	Encore Energy Partners Operating LLC	Madison; Embar-Tensleep; Frontier
BLM – WY RMG	Frannie	Carbon, Montana; Park, Wyoming	Merit Energy	Phosphoria-Embar
MBOGC	Jim Coulee	Musselshell	Beartooth Oil and Gas Company	Tyler
BLM- Miles City FO	Keg Coulee Tyler Sand	Musselshell	Cline Production Co.	Tyler
MBOGC	Kelley	Musselshell	Grand Resources, Ltd	Tyler
MBOGC	Little Wall Creek	Musselshell	Beartooth Oil and Gas Company	Tyler
MBOGC	Little Wall Creek Weisner Sand	Musselshell	Beartooth Oil and Gas Company	Tyler
MBOGC	Little Wall Creek South Gunderson Tyler Sand	Musselshell	Citation Oil & Gas Corporation	Tyler
MBOGC	Little Wall Creek South Hamilton-Gunderson Tyler Sand	Musselshell	Citation Oil & Gas Corporation	Tyler
BLM- Miles City FO	Mason Lake 1st Cat Creek	Musselshell	Jake Oil, LLC	1st Cat Creek
MBOGC	Melstone, North	Musselshell	True Oil Company	Tyler
BLM- Miles City FO	Ragged Point Tyler “A” Sand	Musselshell	Xeric O&G Corp	Tyler “A”
MBOGC	Ragged Point Southwest Tyler “A” Sand	Musselshell	Grand Resources, Ltd	Tyler
BLM- Miles City FO	South Wolf Springs Amsden	Yellowstone	Beartooth O&G	Amsden
BLM- Miles City FO	Stensvad	Musselshell and Rosebud	Tomahawk Oil Co.	Stensvad zone (Tyler)
MBOGC	Willow Creek North	Musselshell	R & A Oil, Inc	Tyler
MBOGC	Winnett Junction	Musselshell	Beartooth Oil and Gas Company	Tyler

Secondary unit agreements often will go into ‘tertiary’ recovery, as the operator employs other methods such as injecting polymers or other chemicals, or CO_2 into the producing horizon as a means of recovering more of the oil and gas within the reservoir. These additional operations become increasingly expensive and may recovery smaller volumes of oil, yet they may be profitable because facilities and infrastructure are already in place.

Secondary and enhanced recovery projects that had not been considered previously may be revisited by industry when there are favorable conditions, such as higher forecasted oil and gas prices. Another factor could be an increased knowledge base of the geologic characteristics of the reservoirs, and technological improvements that reduce costs or increase recovery. Also, construction of a pipeline that can transport CO_2 in proximity to an oil field may be a further incentive to pursue enhanced recovery at that field.

Gas Storage Areas

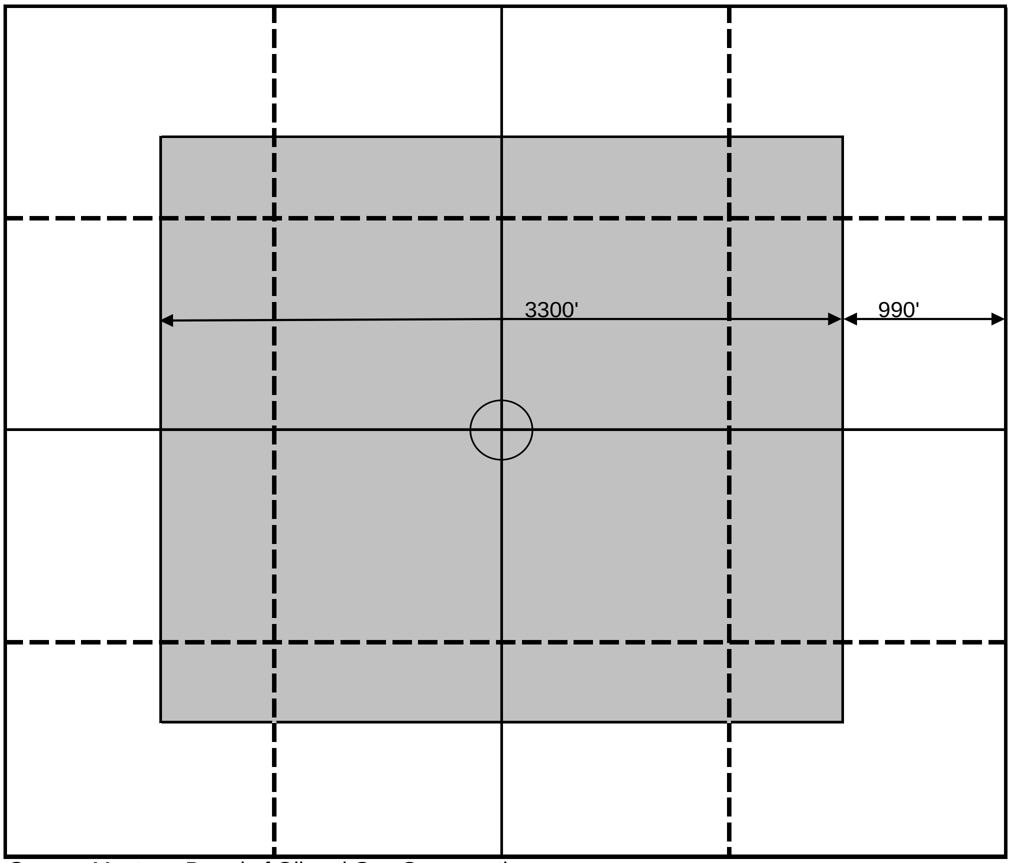
The Dry Creek area in Carbon County is a BLM and State-administered ‘Gas Storage Agreement’, where the operator injects gas into the subsurface formations to store produced gas in the low demand – summer -- months, and withdraws gas during the high demand – winter -- months. There is also a non-Federally administered gas storage area in the Elk Basin field. Leases located within a gas storage agreement remain in effect until the gas storage agreement is terminated.

Well Spacing Requirements

Spacing is established to both protect the correlative rights of adjacent mineral owners, and to permit the maximum efficient recovery of the oil and gas reserves. Spacing considers the reservoir parameters in order to determine the proper number and location of wells to result in maximum oil and gas recovery. ‘Efficiency’ thus represents both the economics of field development drilling and the anticipated volumes of recoverable oil and gas.

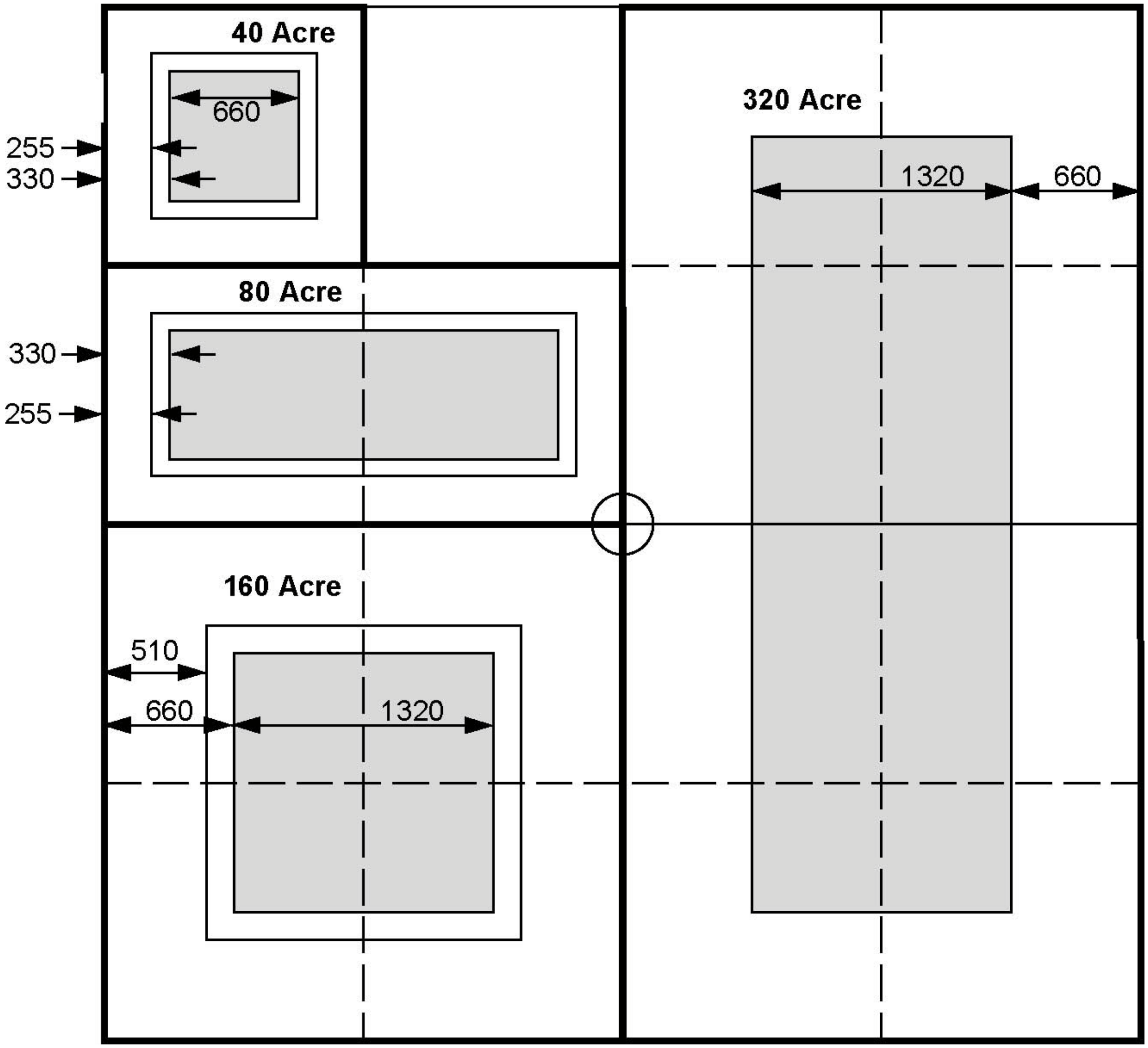
The plats below show the statewide spacing rules for oil and gas wells set by the MBOGC. To protect correlative rights, a well should be drilled within the shaded area. The distance from the exterior boundary of the spacing unit is described as the ‘setback’. An operator may request approval of an ‘exception’ location when, because of surface (i.e., wildlife, cultural, topographic) or subsurface (geological) reasons, the well may not be drilled from a standard location. The MBOGC considers the correlative rights of the adjacent mineral owners (the likelihood that their oil and gas may be drained) prior to approval of the exception location.

640 ACRE GAS WELL SPACING SECTION PLAT



Source: Montana Board of Oil and Gas Conservation

OIL WELL SPACING SECTION PLAT

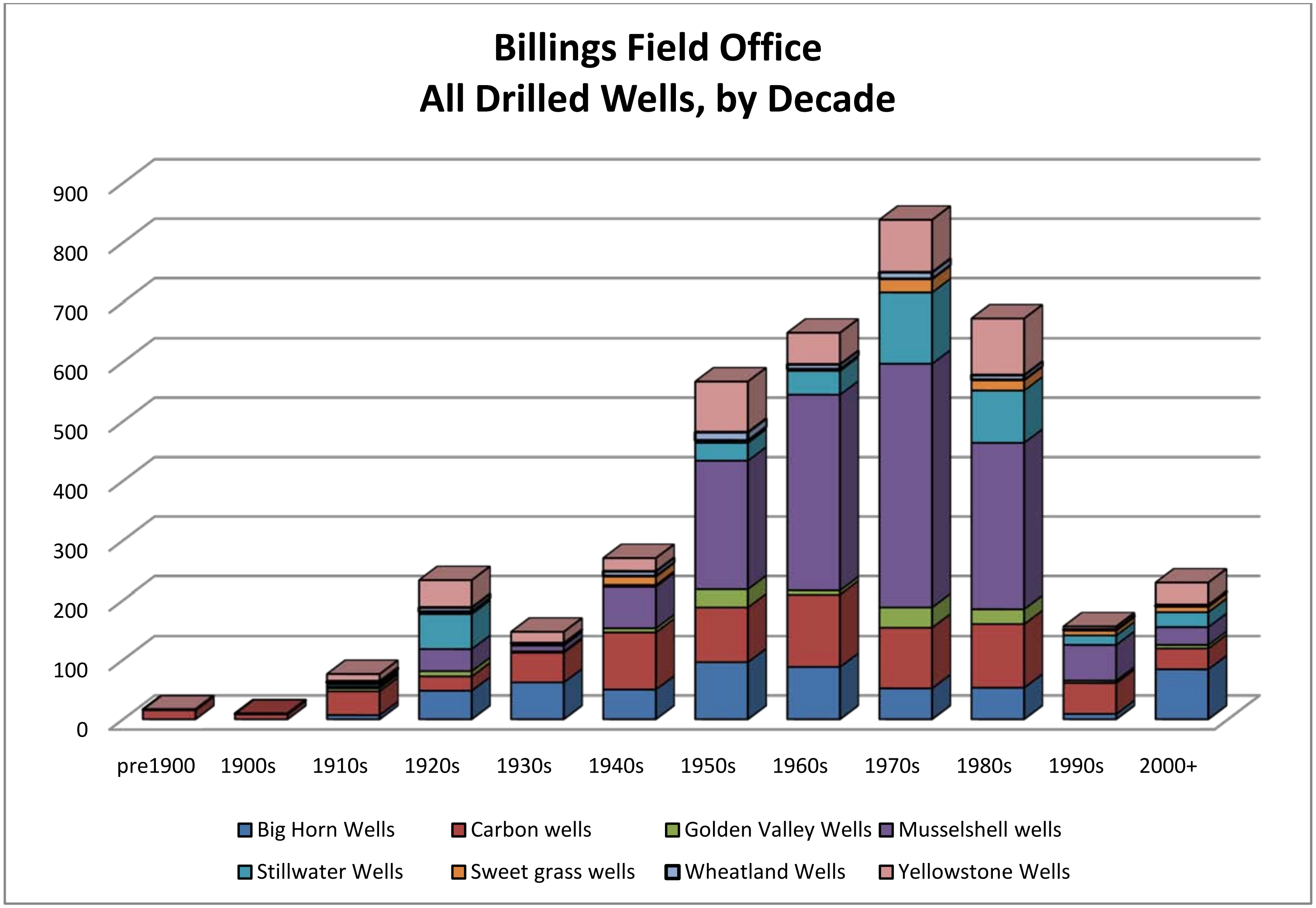


Well Depth (feet)	Spacing (acres)	Nearest Boundary (feet)	Topographic Tolerance (feet)	Minimum Well Distance (feet)
0 - 6,000	40 & 80	330	75	255
6,001 - 11,000	160	660	150	510
> 11,001	320	660	none	none
For 320 acre spacing (1,650 well tolerance) and 80 acre spacing, the drilling unit will be delineated either N-S or E-W				

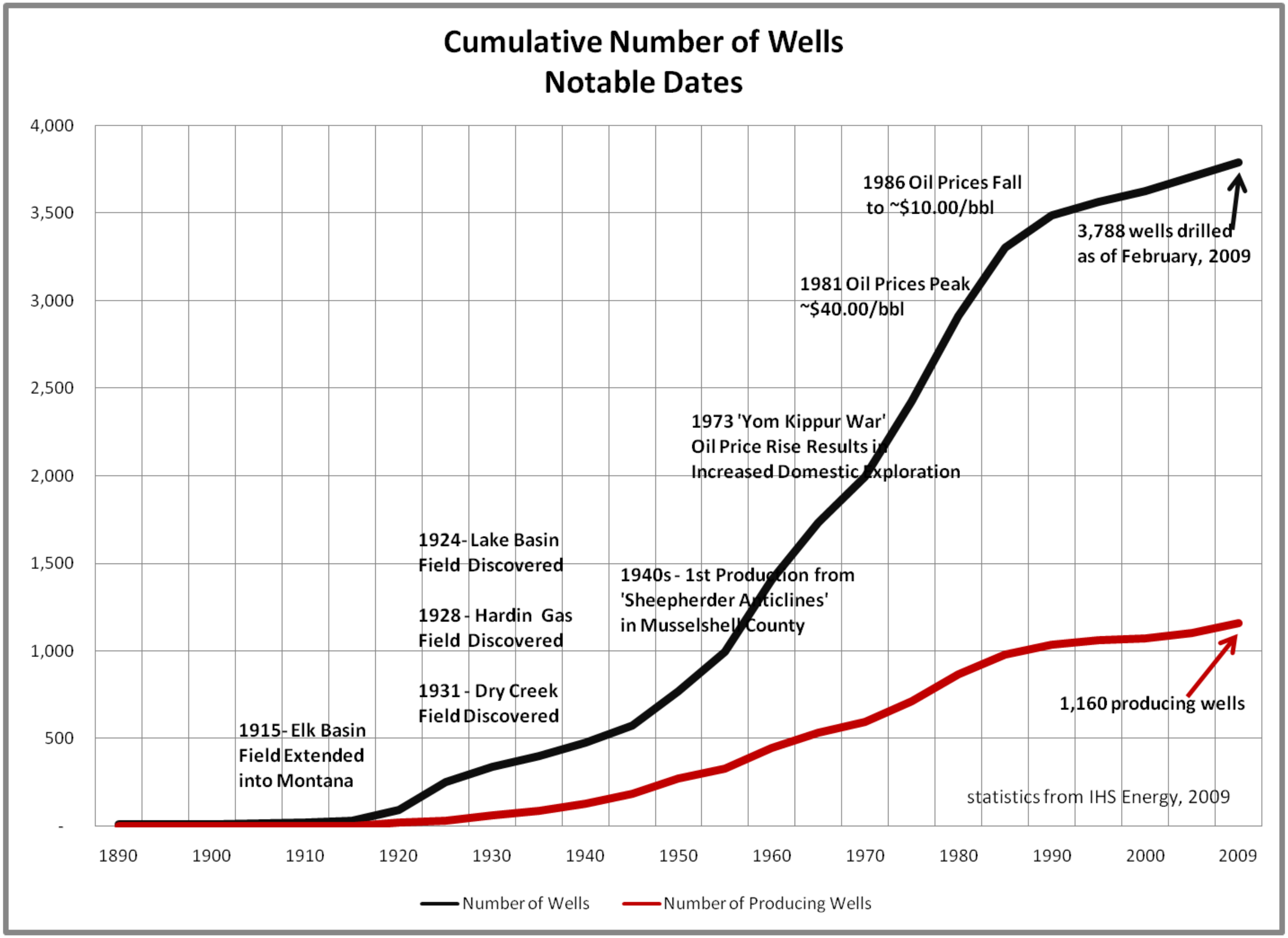
SOURCE: Montana Board of Oil & Gas Conservation (36.22.702)

Appendix B is modified from the 2008 Report from the MBOGC. It lists the oil and gas fields within the BiFO, the number of active wells by reservoir, calendar year 2008 oil and gas production and the spacing rules (if any) that have established for the reservoirs. Where listed in the regulation summary, “Statewide” spacing for oil wells in the Billings Field Office is 40 acres, and for gas wells, 160 acres. The table also identifies reservoirs within the fields that have gone into secondary recovery.

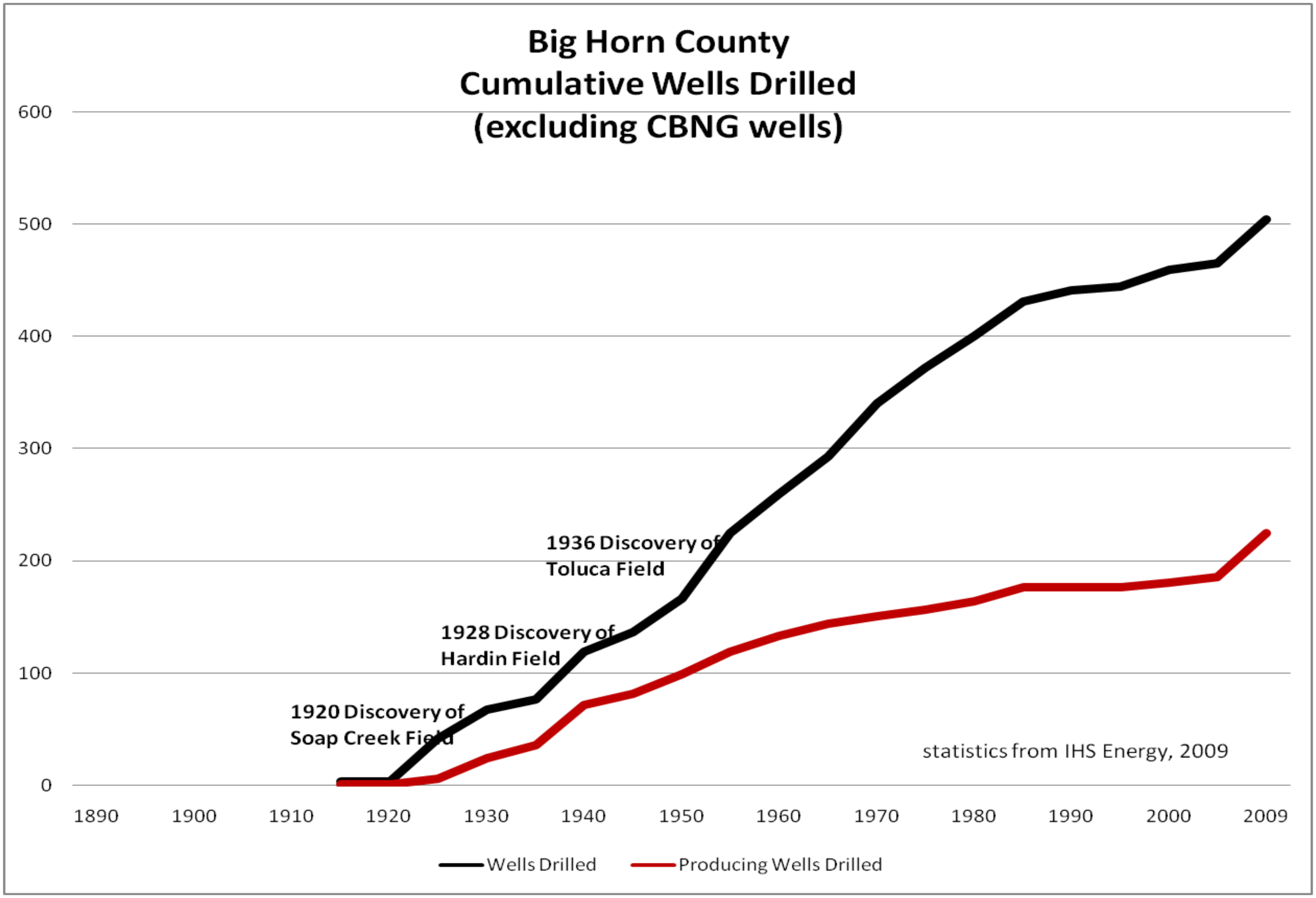
The graphs on the following pages provide overall drilling and completion statistics, and drilling and completion statistics by county.


Billings Field Office
All Drilled Wells, by Decade
900
800
700
600
500
400
300
200
100
0
pre1900
1900s
1910s
1920s
1930s
1940s
1950s
1960s
1970s
1980s
1990s
2000+
Big Horn Wells
Carbon wells
Golden Valley Wells
Musselshell wells
Stillwater Wells
Sweet grass wells
Wheatland Wells
Yellowstone Wells

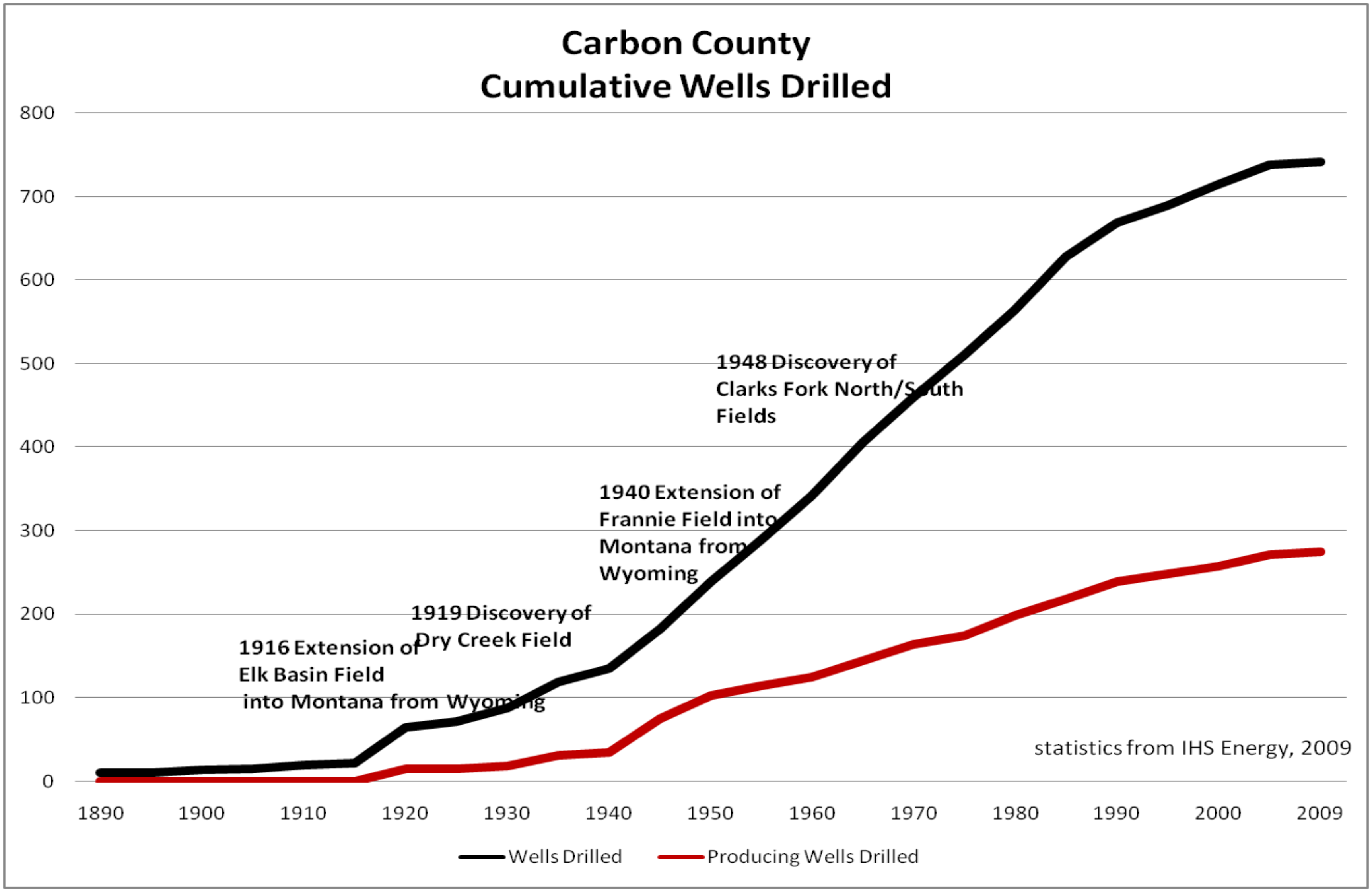
Cumulative drilling/notable dates



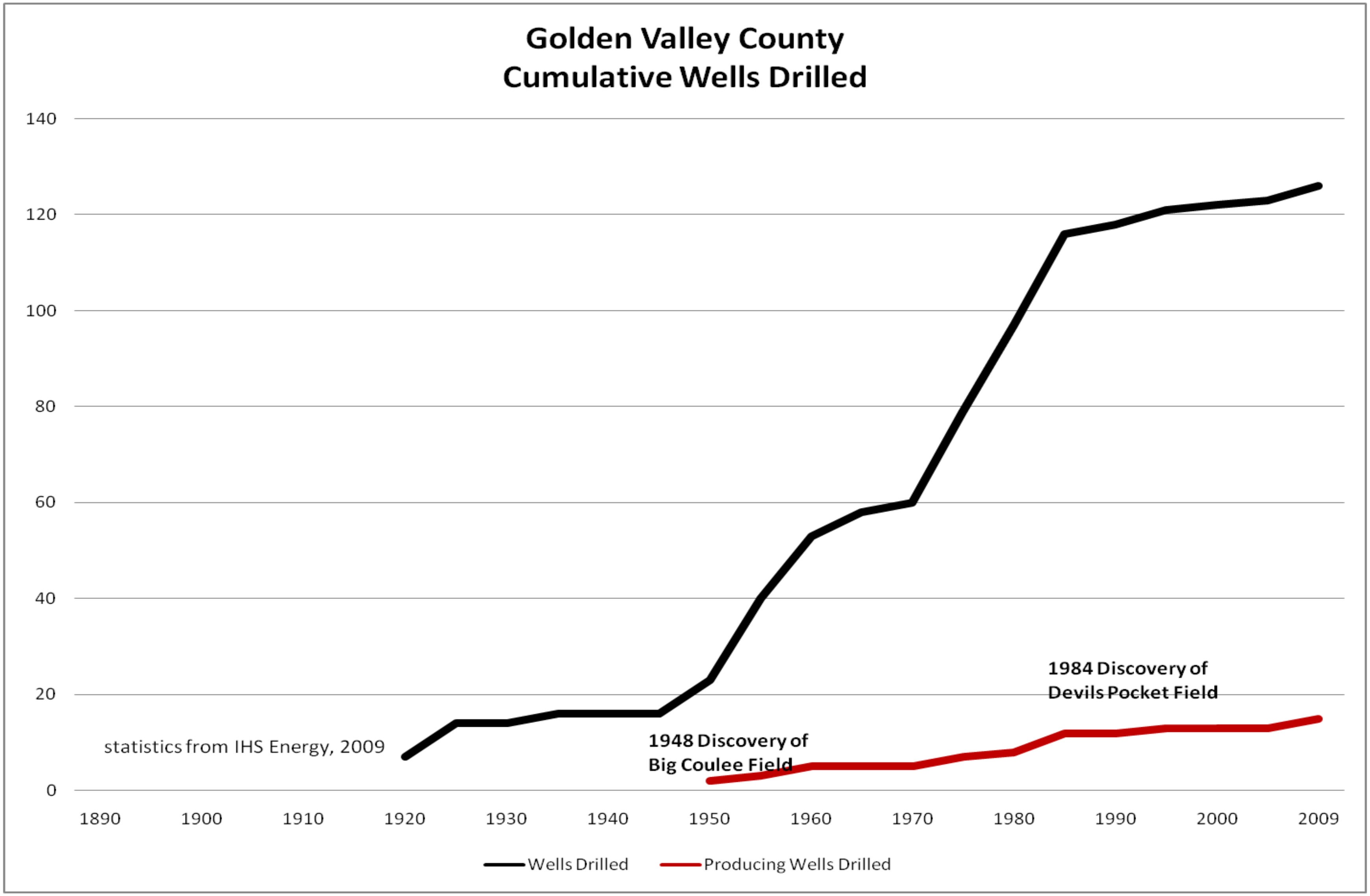
Big Horn County Drilling History



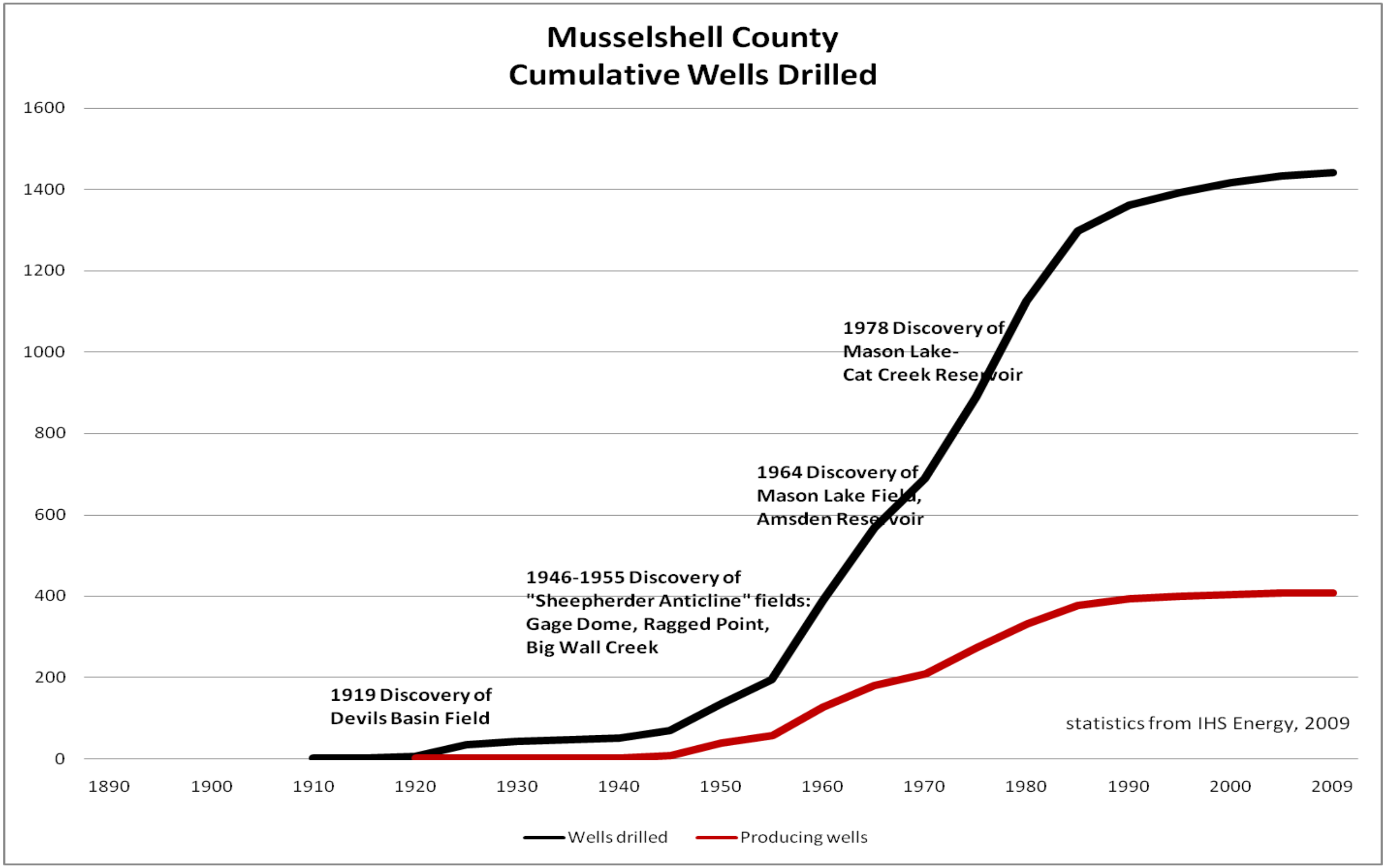
Carbon County Drilling History



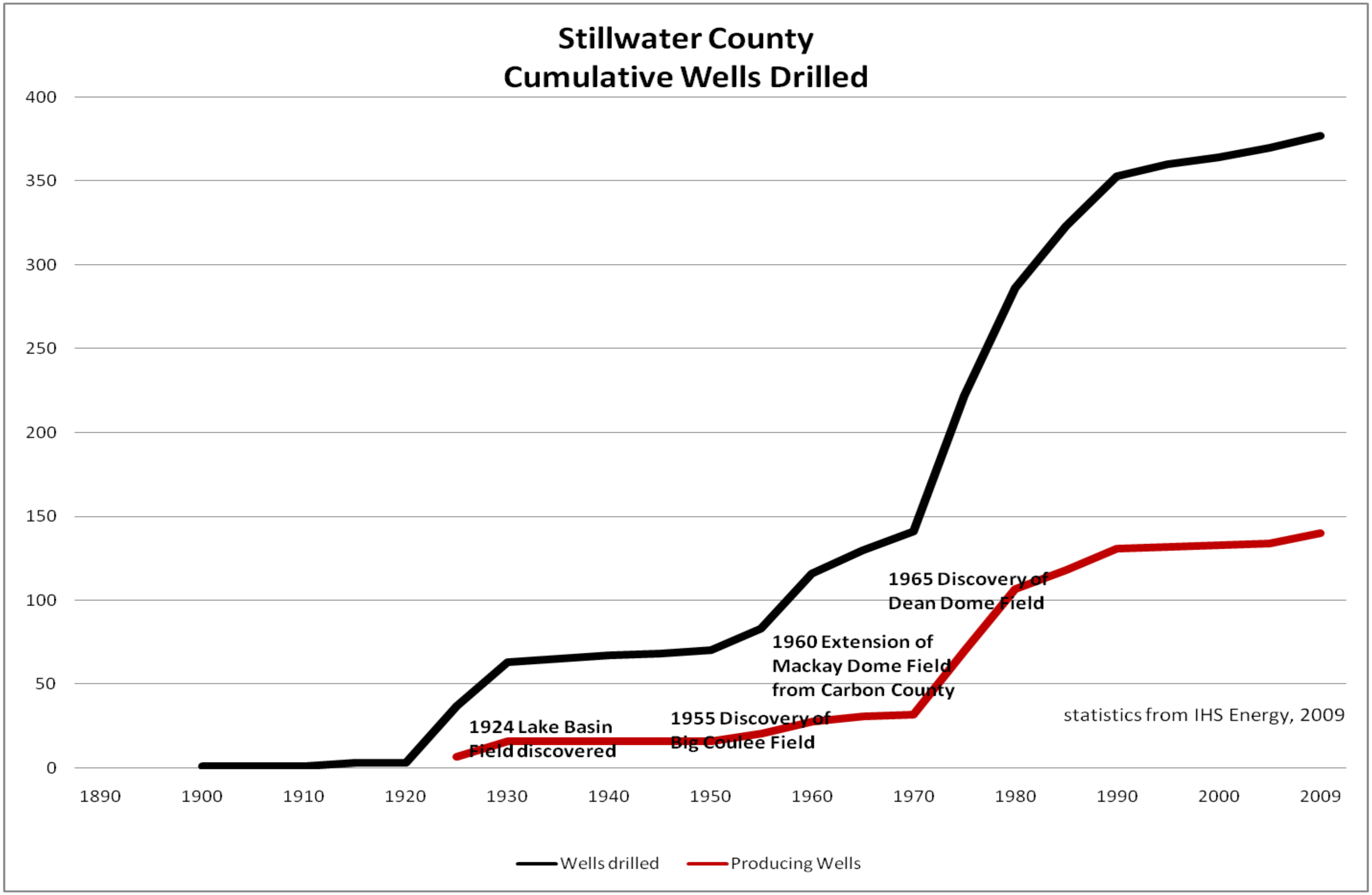
Golden Valley County Drilling History



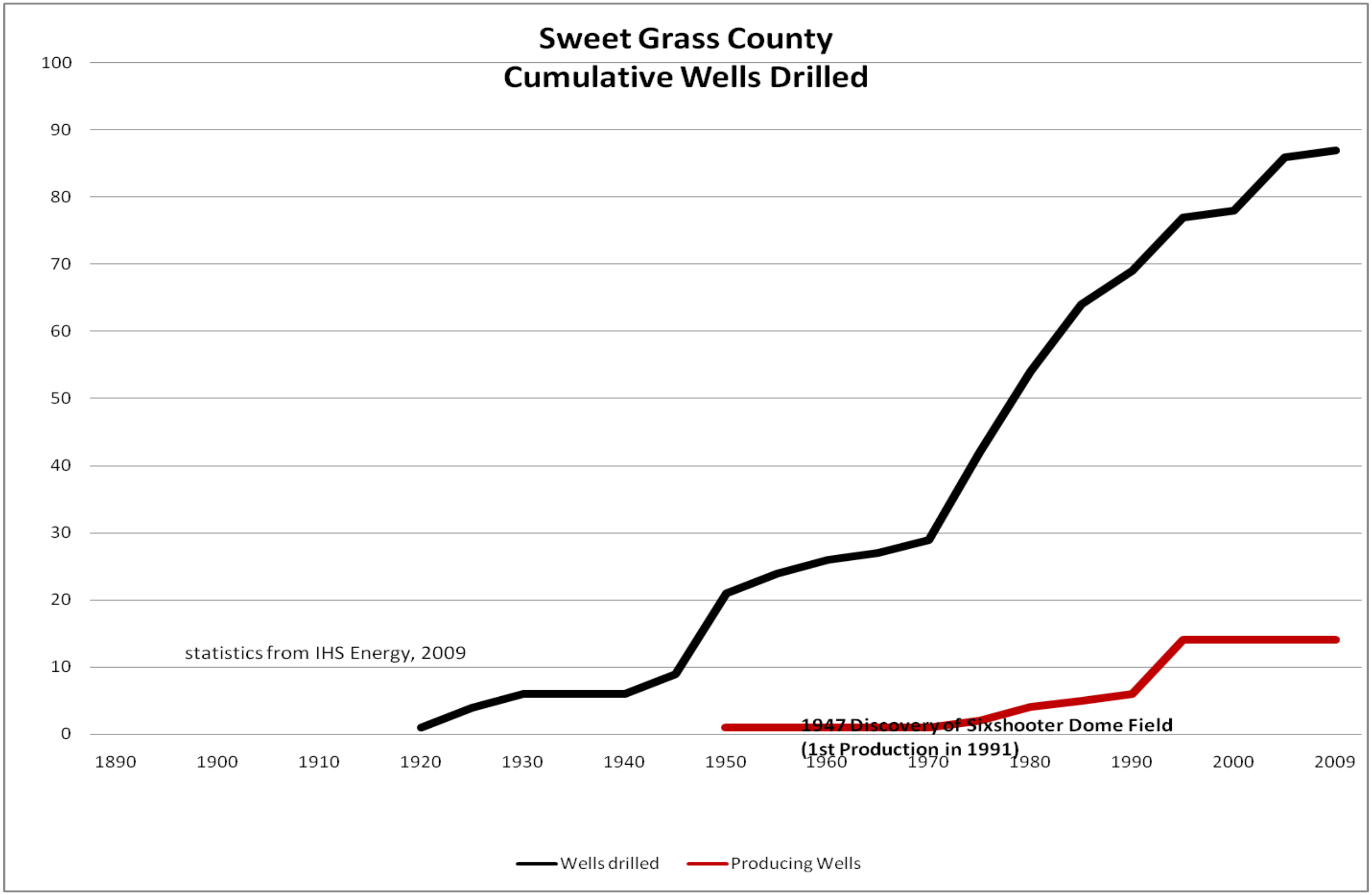
Musselshell County Drilling History



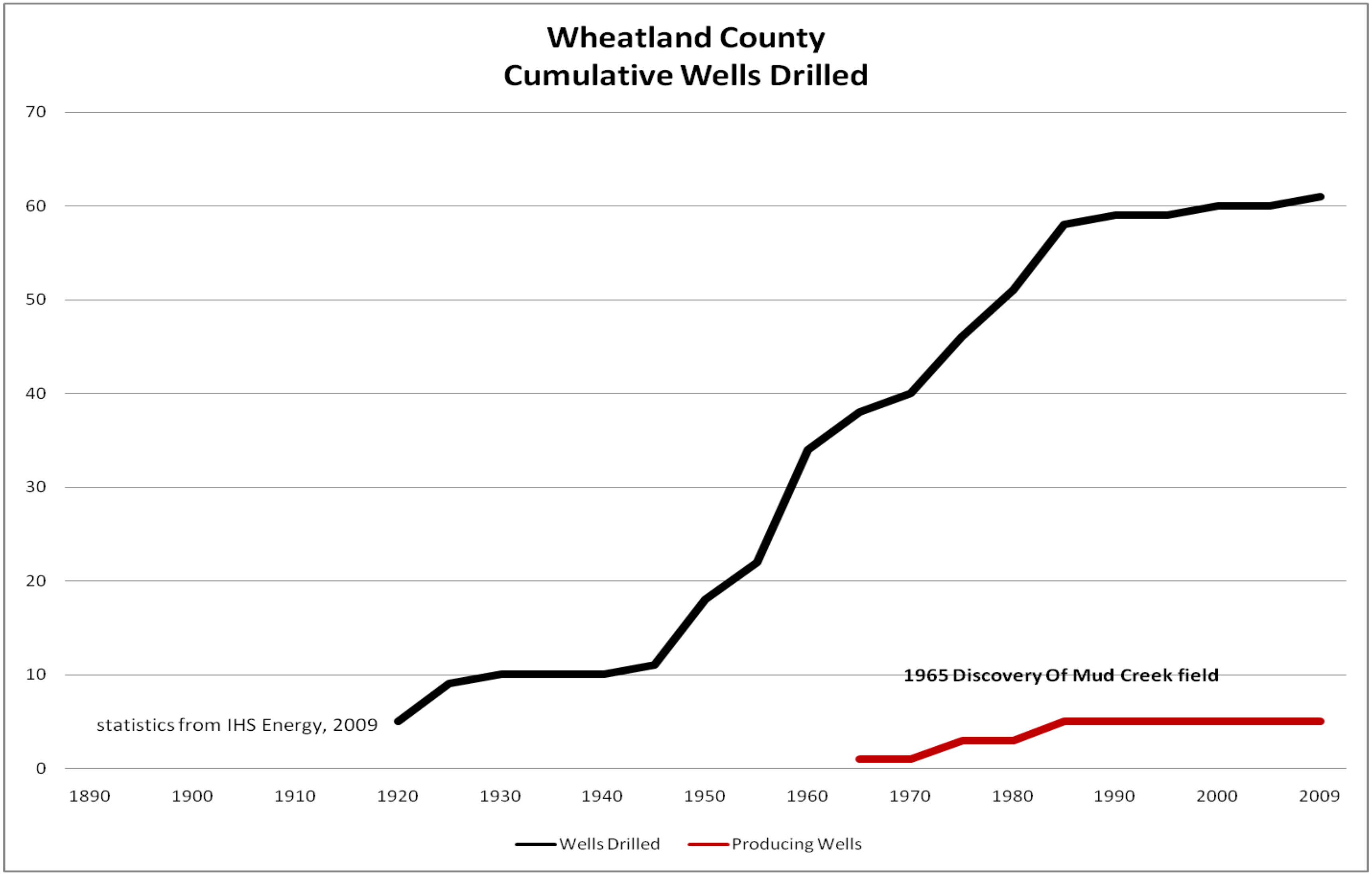
Stillwater County Drilling History



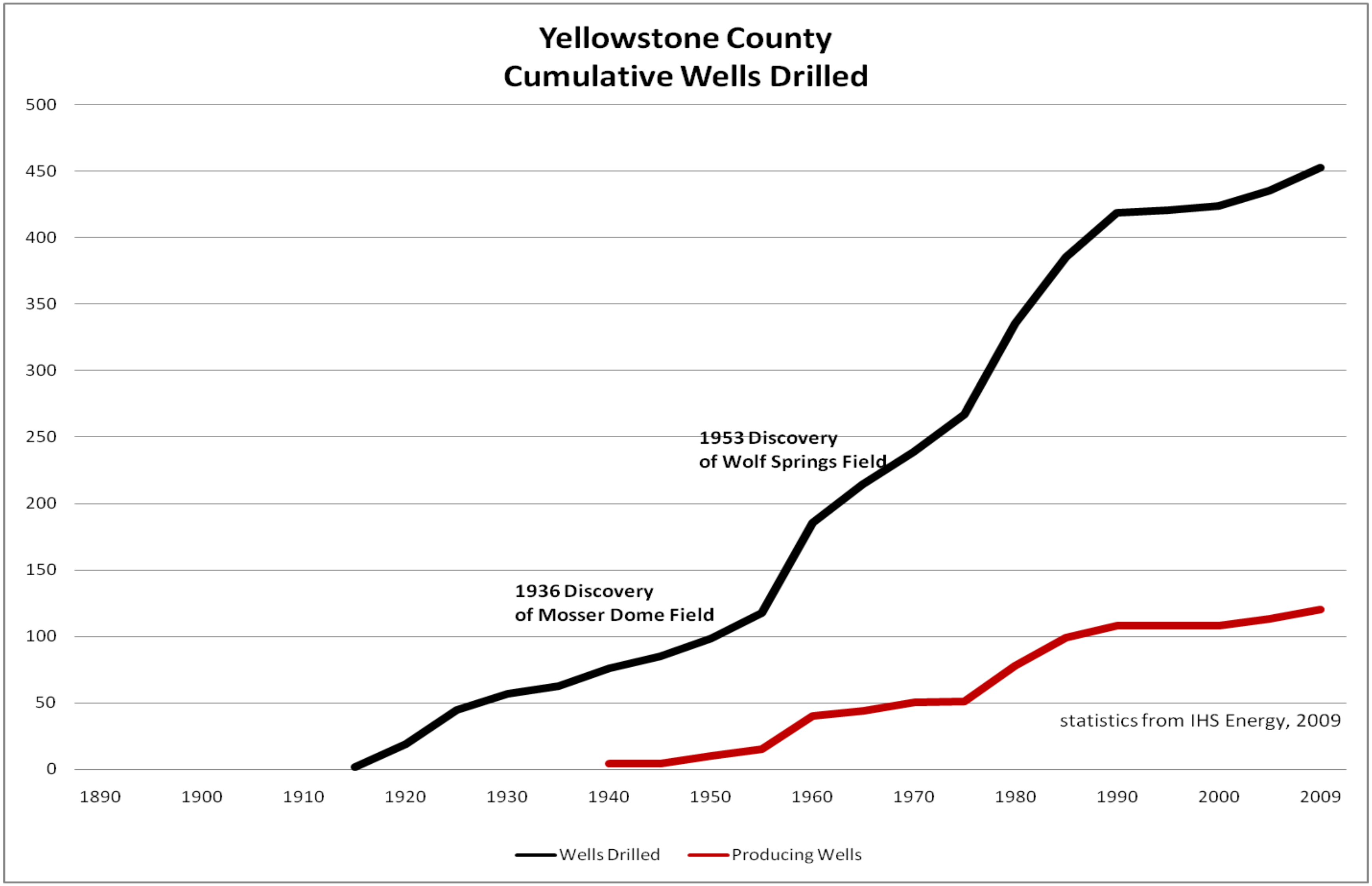
Sweet Grass County Drilling History



Wheatland County Drilling History



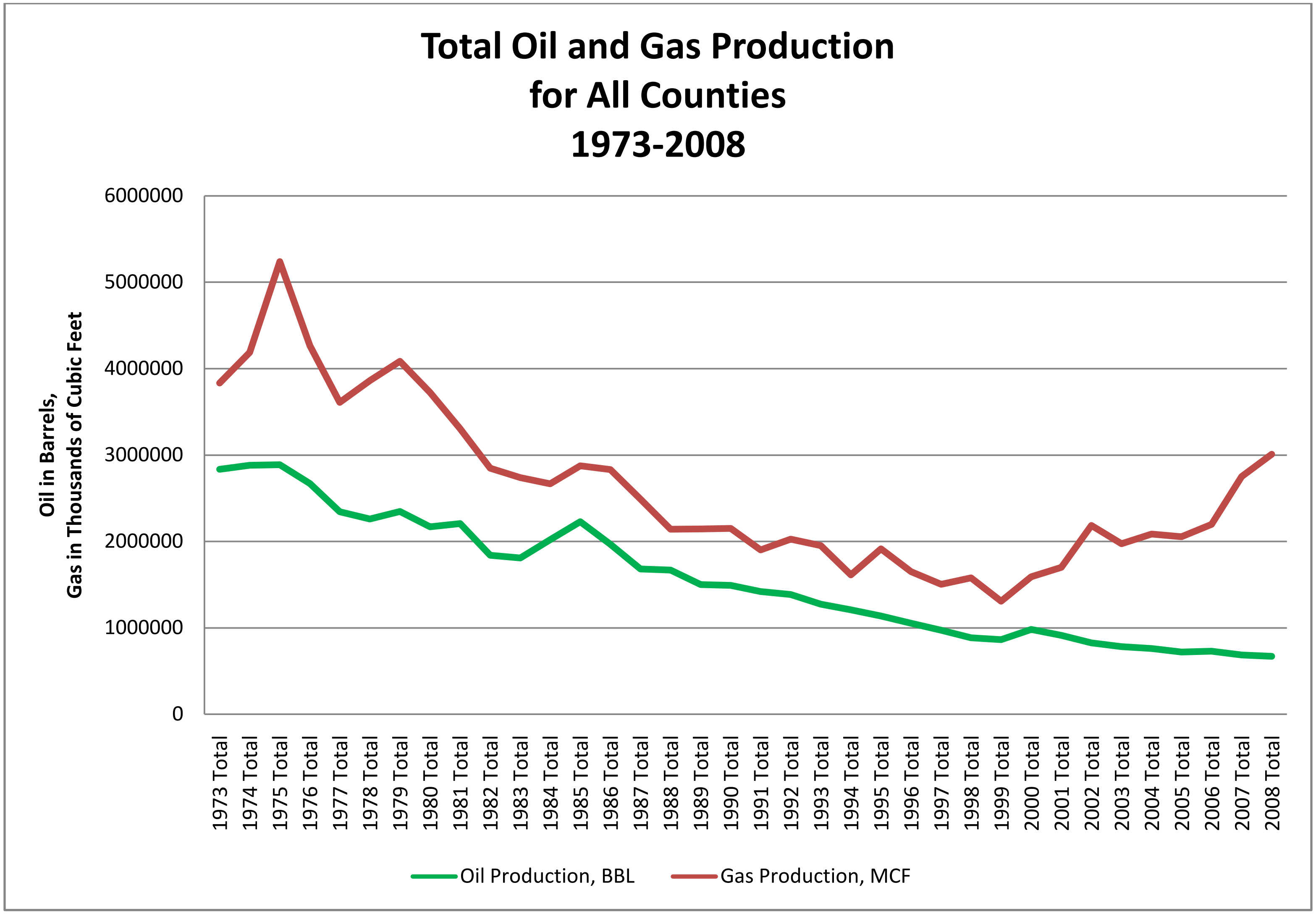
Yellowstone County Drilling History

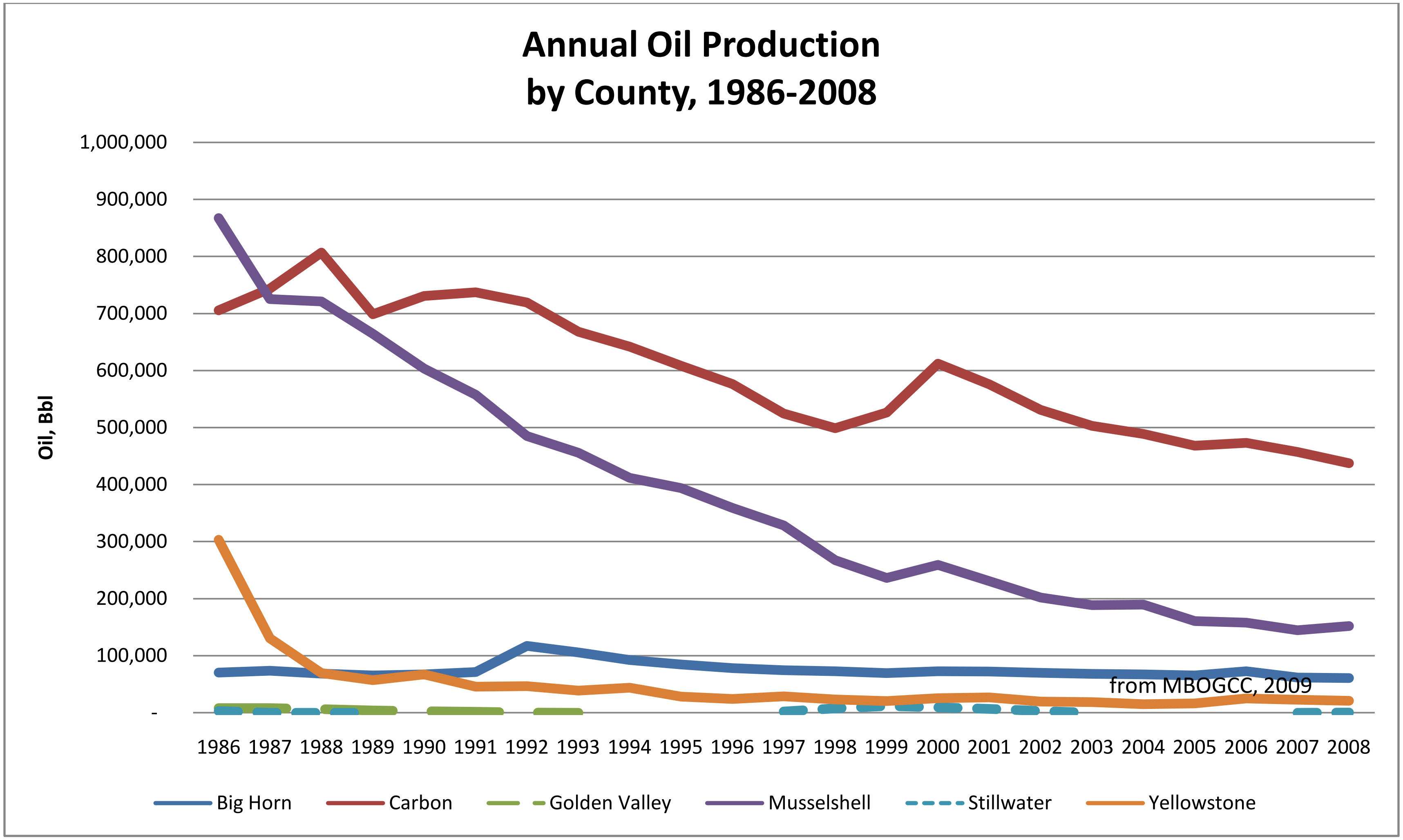


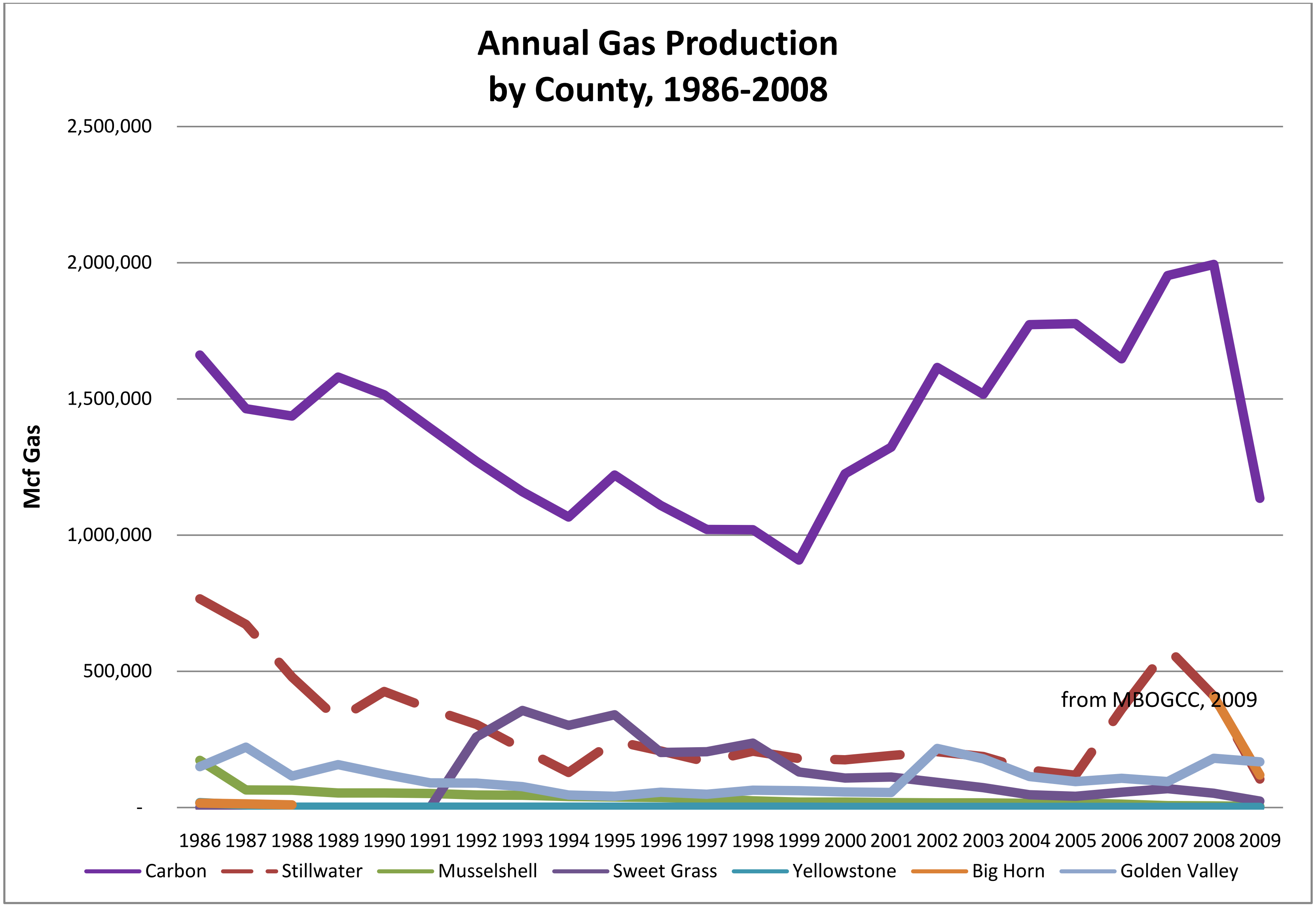
Horizontal and deviated drilling practices

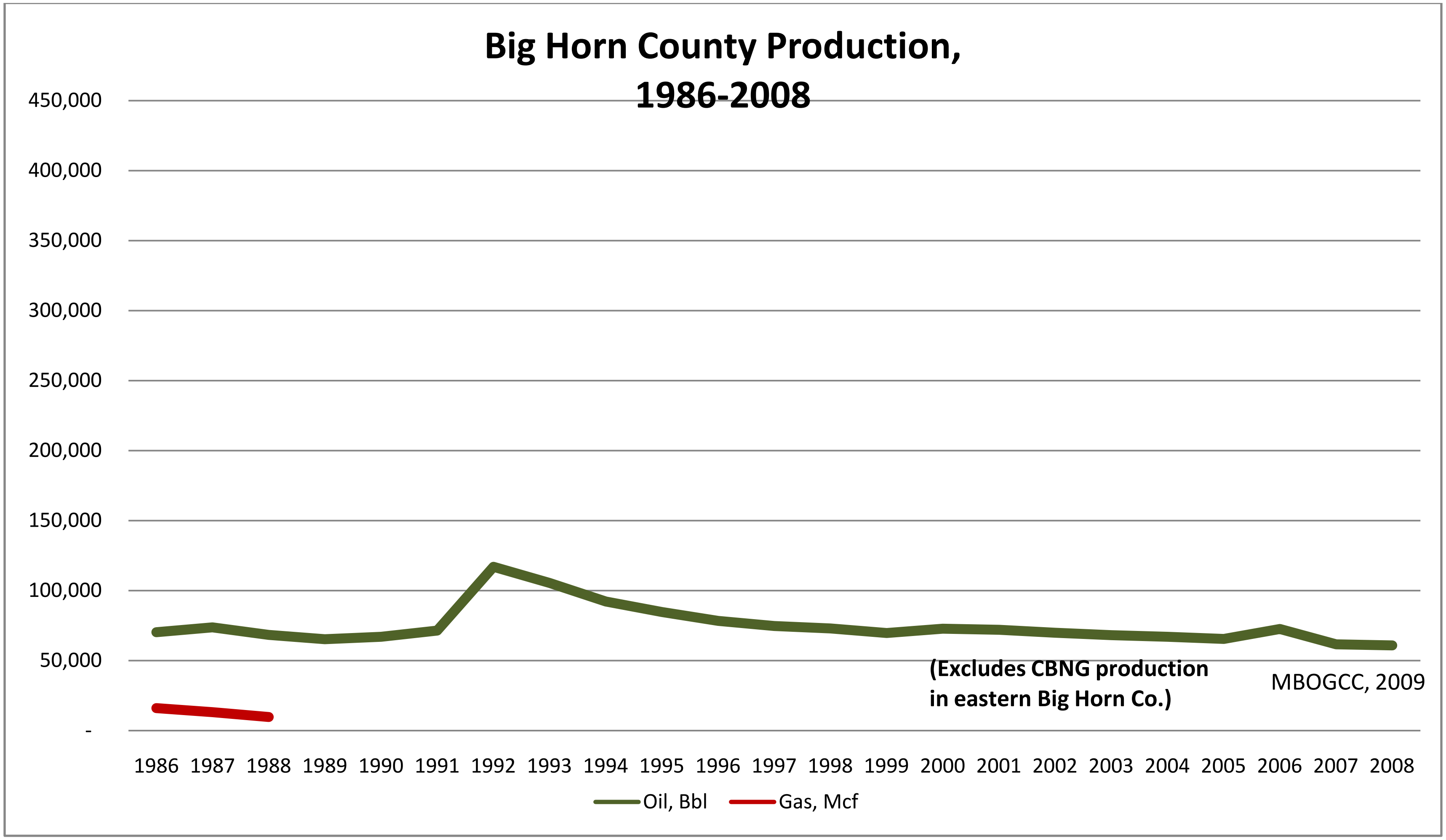
Available records indicate that out of over 3,800 permitted well bores, only 33 wells were non-vertical completions. Most of the 13 horizontal completions were drilled within existing fields, possibly with the intent of accessing bypassed oil and gas. Over half of these wells were successful, but also encountered high volumes of water. The 20 directional wells were drilled because surface locations wouldn't have been available for vertical wells. Outside of the emerging shale play in Sweet Grass and Park Counties, the BLM does not believe that the nature of the known reservoirs (their geologic structure and reservoir extent) is conducive to horizontal drilling and development.

The charts on the following pages provide an overall view of oil and gas production within the Billings Field Office as a whole, and by County. The charts do not include year-to-date 2009 production.

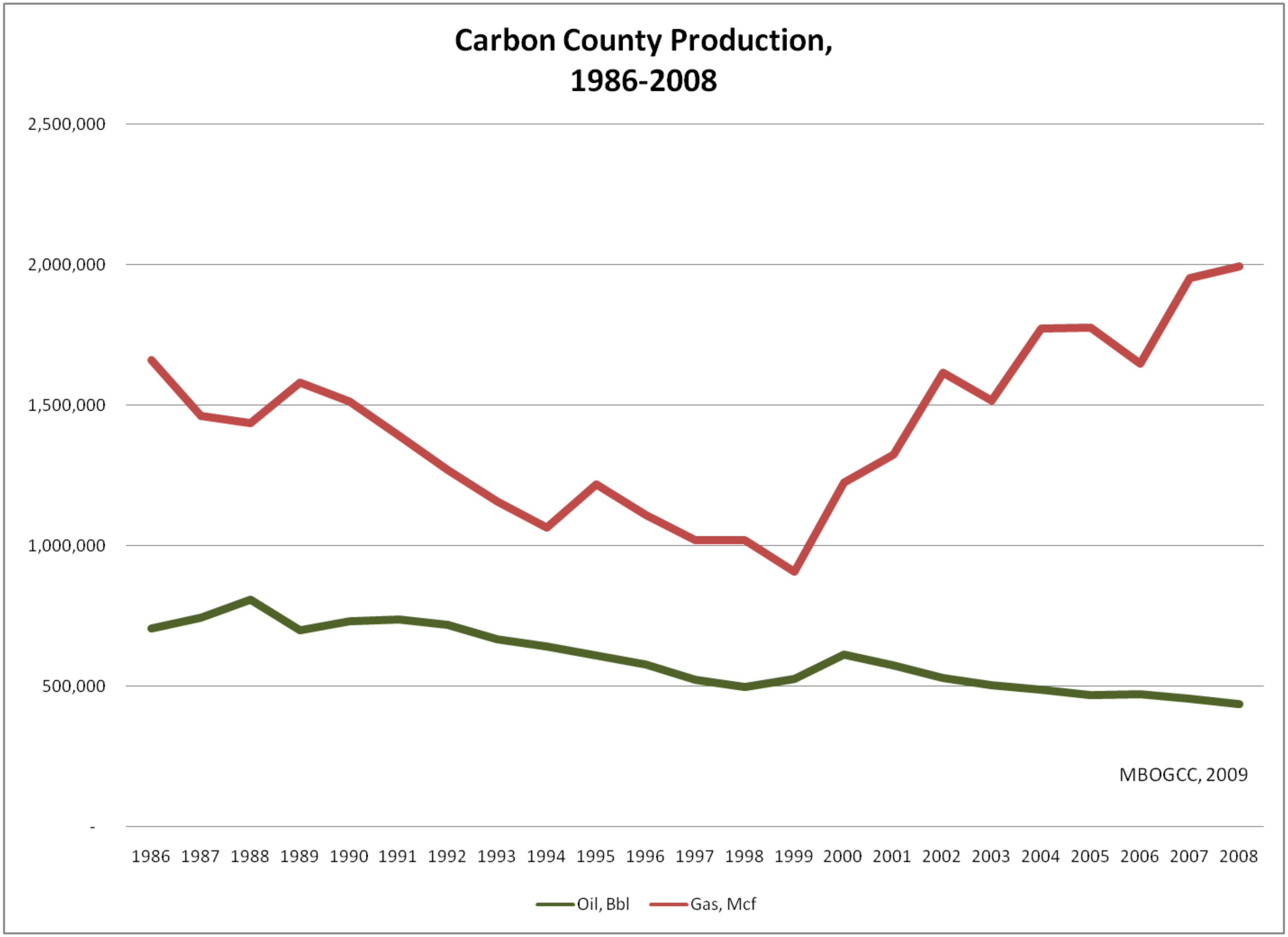



Annual Oil Production
by County, 1986-2008
Oil, Bbl
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
from MBOGCC, 2009
Big Horn
Carbon
Golden Valley
Musselshell
Stillwater
Yellowstone

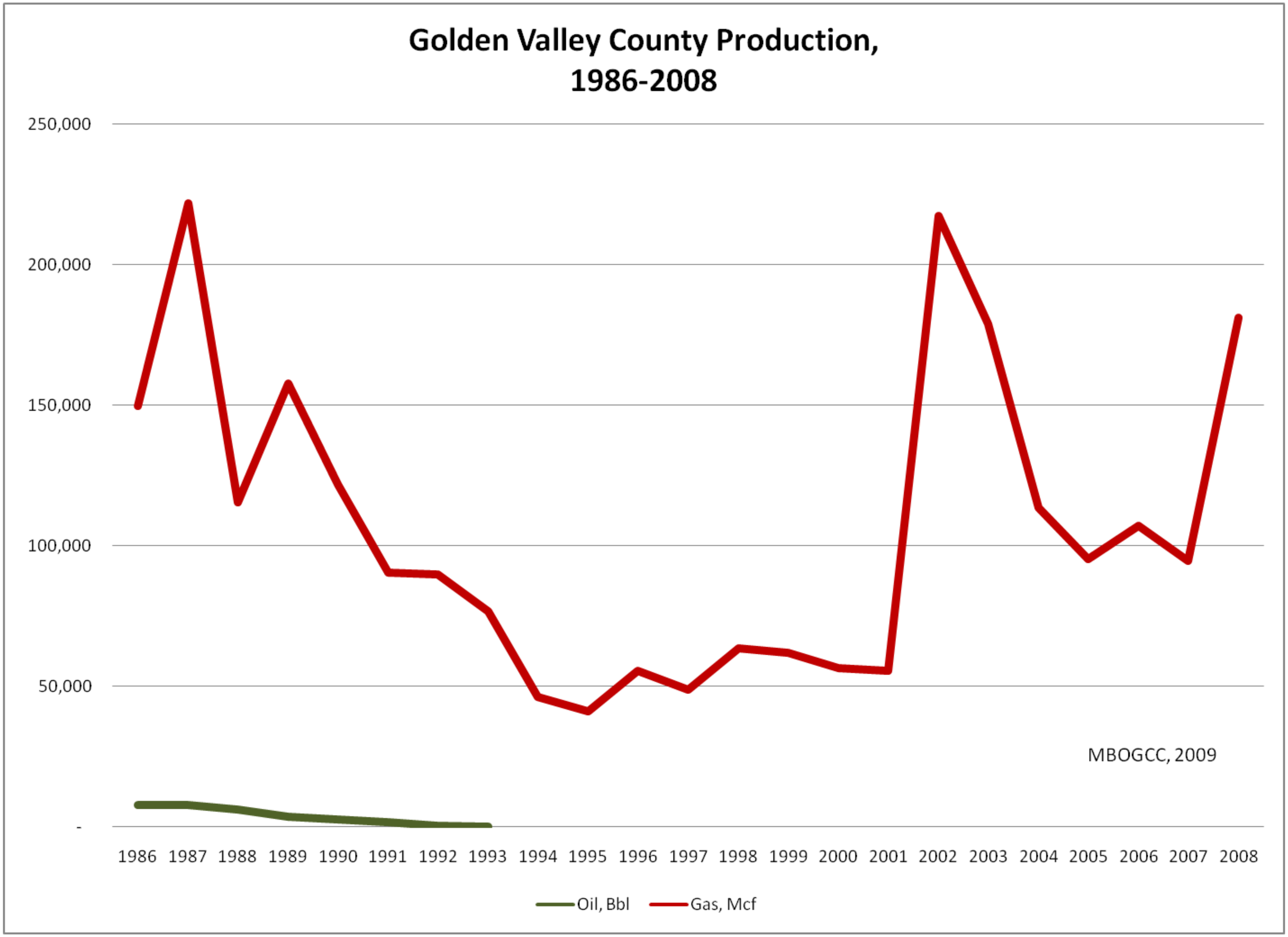

Annual Gas Production
by County, 1986-2008
Mcf Gas
2,500,000
2,000,000
1,500,000
1,000,000
500,000
-
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009
from MBOGCC, 2009
Carbon
Stillwater
Musselshell
Sweet Grass
Yellowstone
Big Horn
Golden Valley



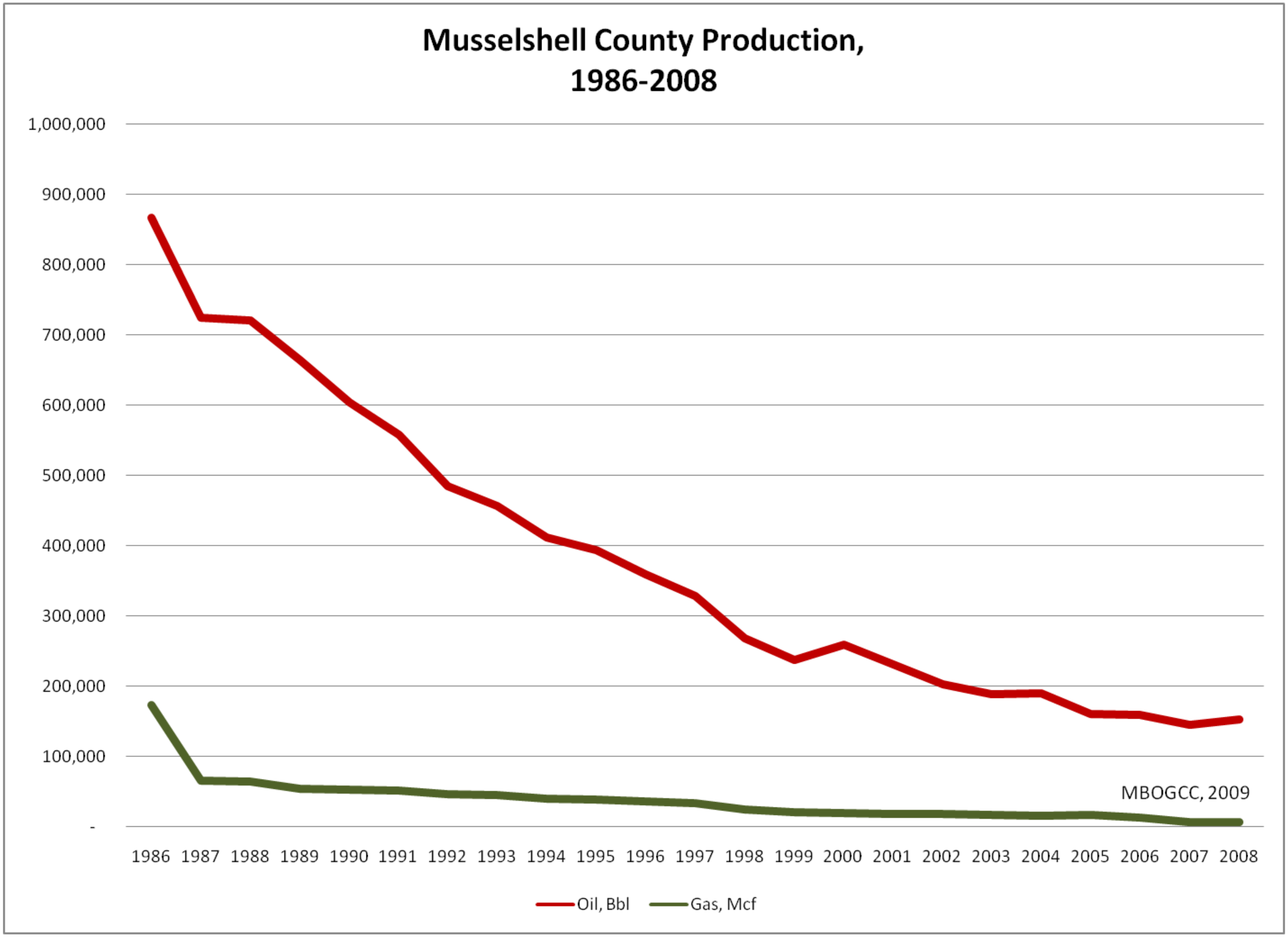
Big Horn County Production,
1986-2008
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
-
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Oil, Bbl
Gas, Mcf
(Excludes CBNG production
in eastern Big Horn Co.)
MBOGCC, 2009



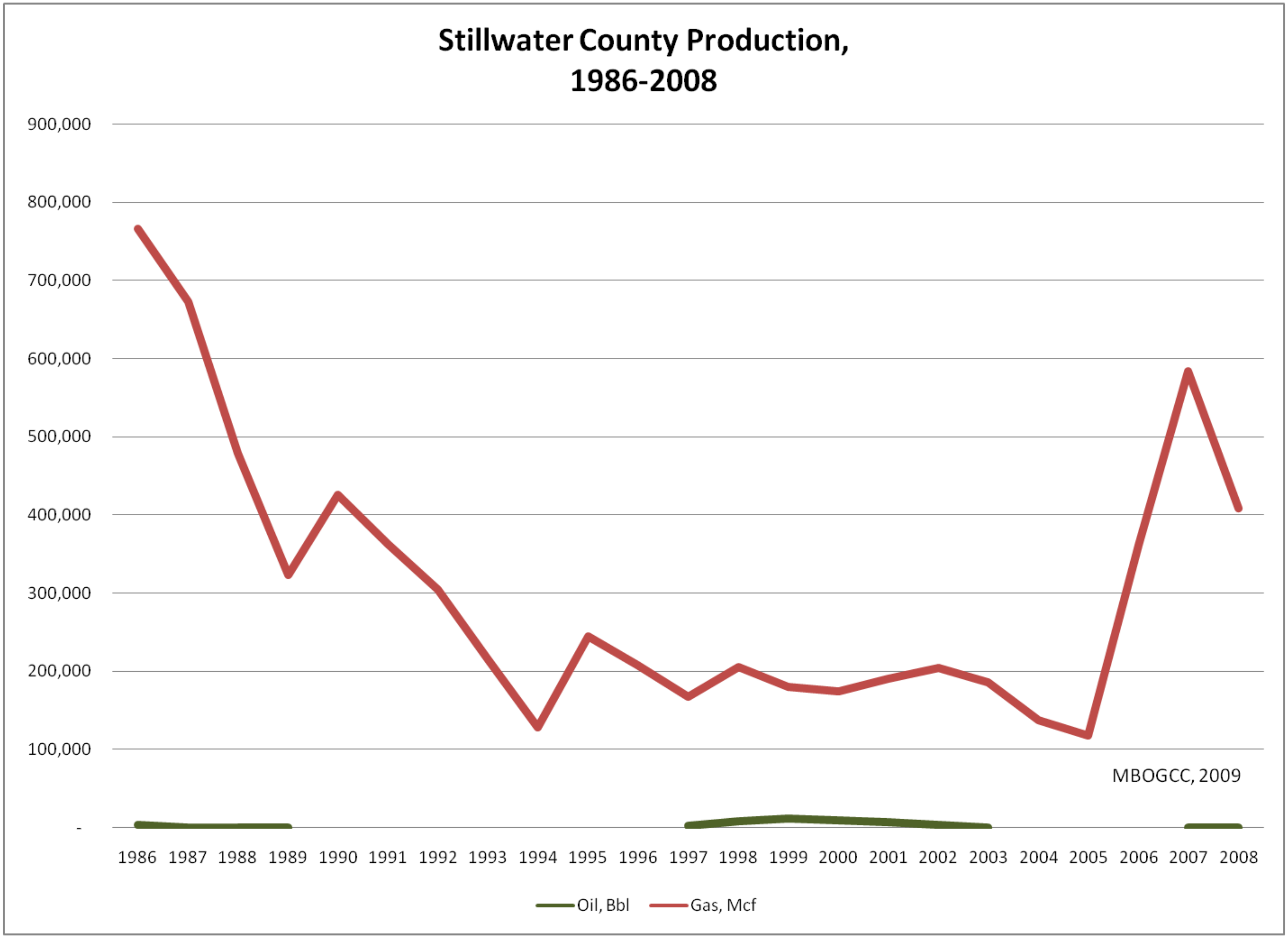
Carbon County Production,
1986-2008
2,500,000
2,000,000
1,500,000
1,000,000
500,000
-
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
MBOGCC, 2009
Oil, Bbl
Gas, Mcf

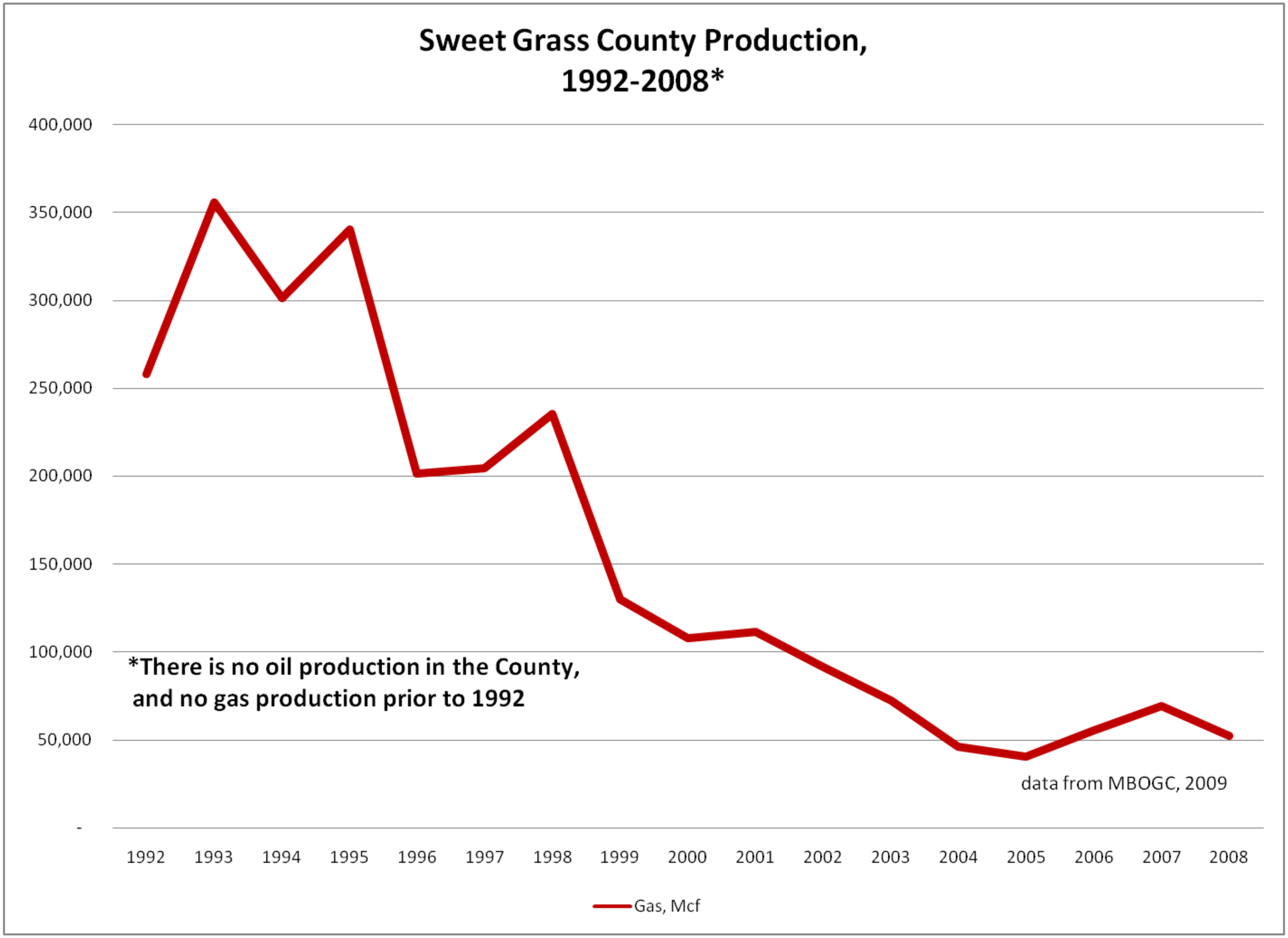


Golden Valley County Production,
1986-2008
250,000
200,000
150,000
100,000
50,000
-
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
MBOGCC, 2009
Oil, Bbl
Gas, Mcf

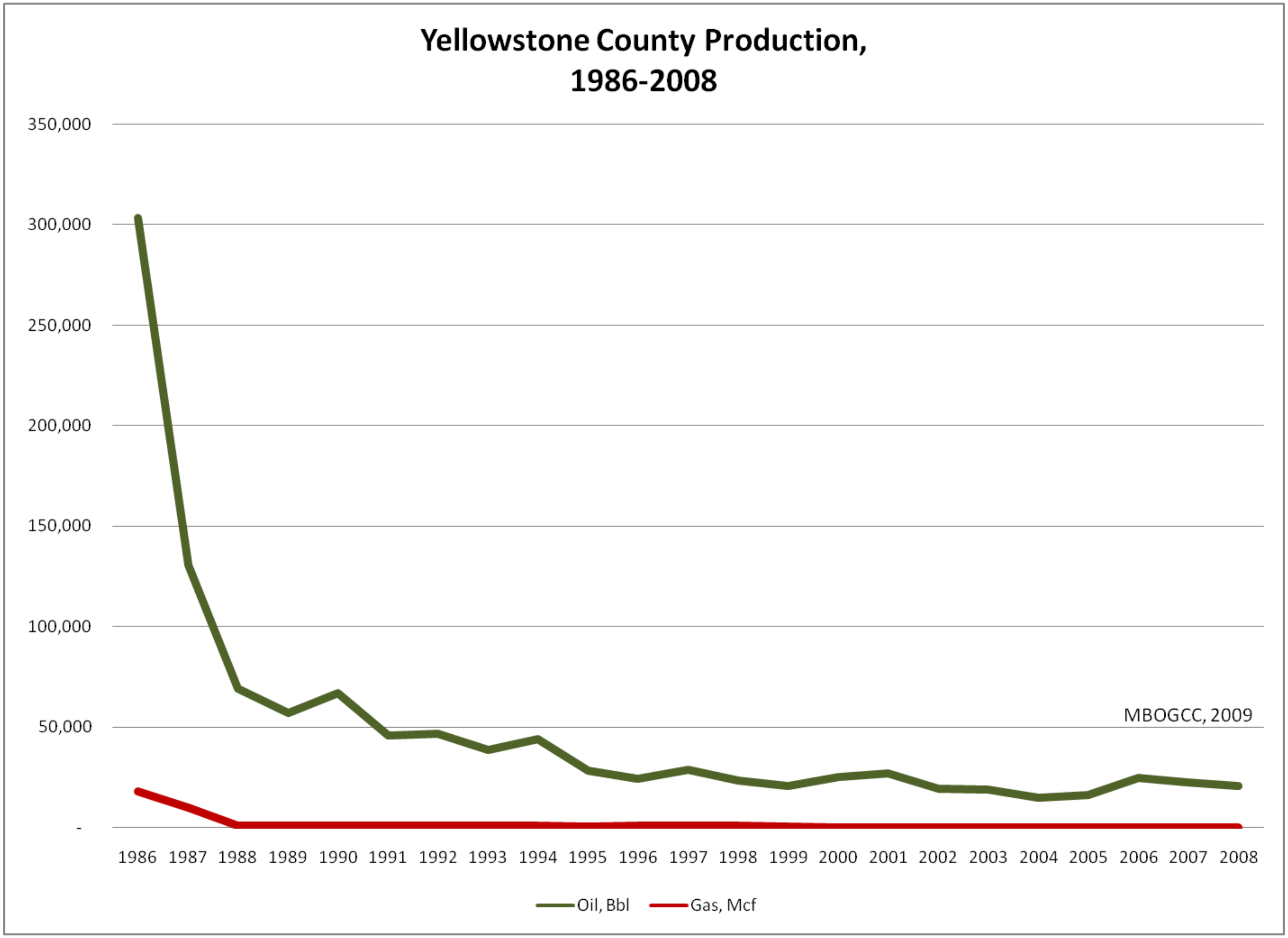


Musselshell County Production,
1986-2008
1,000,000
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
MBOGCC, 2009
Oil, Bbl
Gas, Mcf

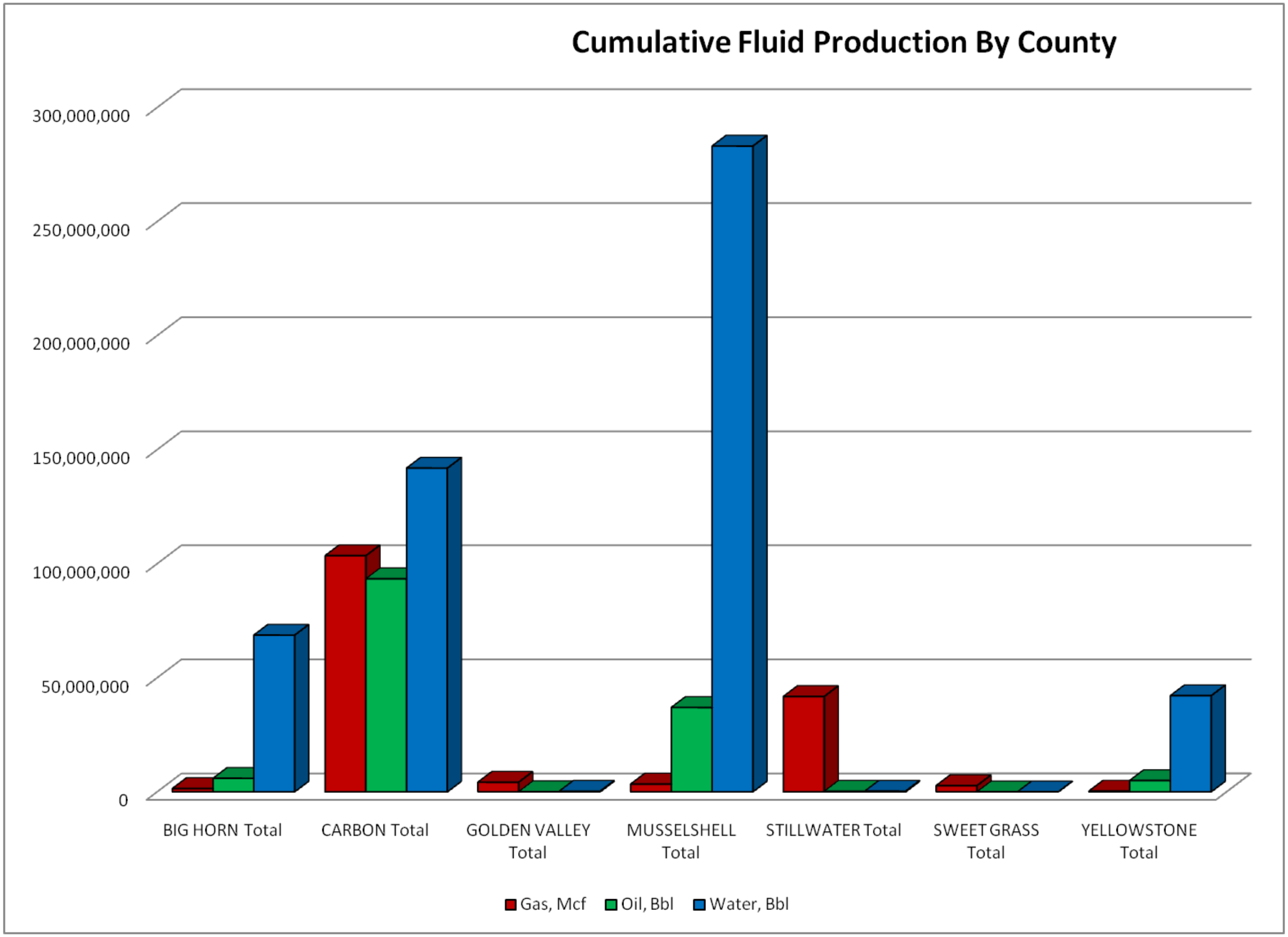

Stillwater County Production,
1986-2008
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
MBOGCC, 2009
Oil, Bbl
Gas, Mcf

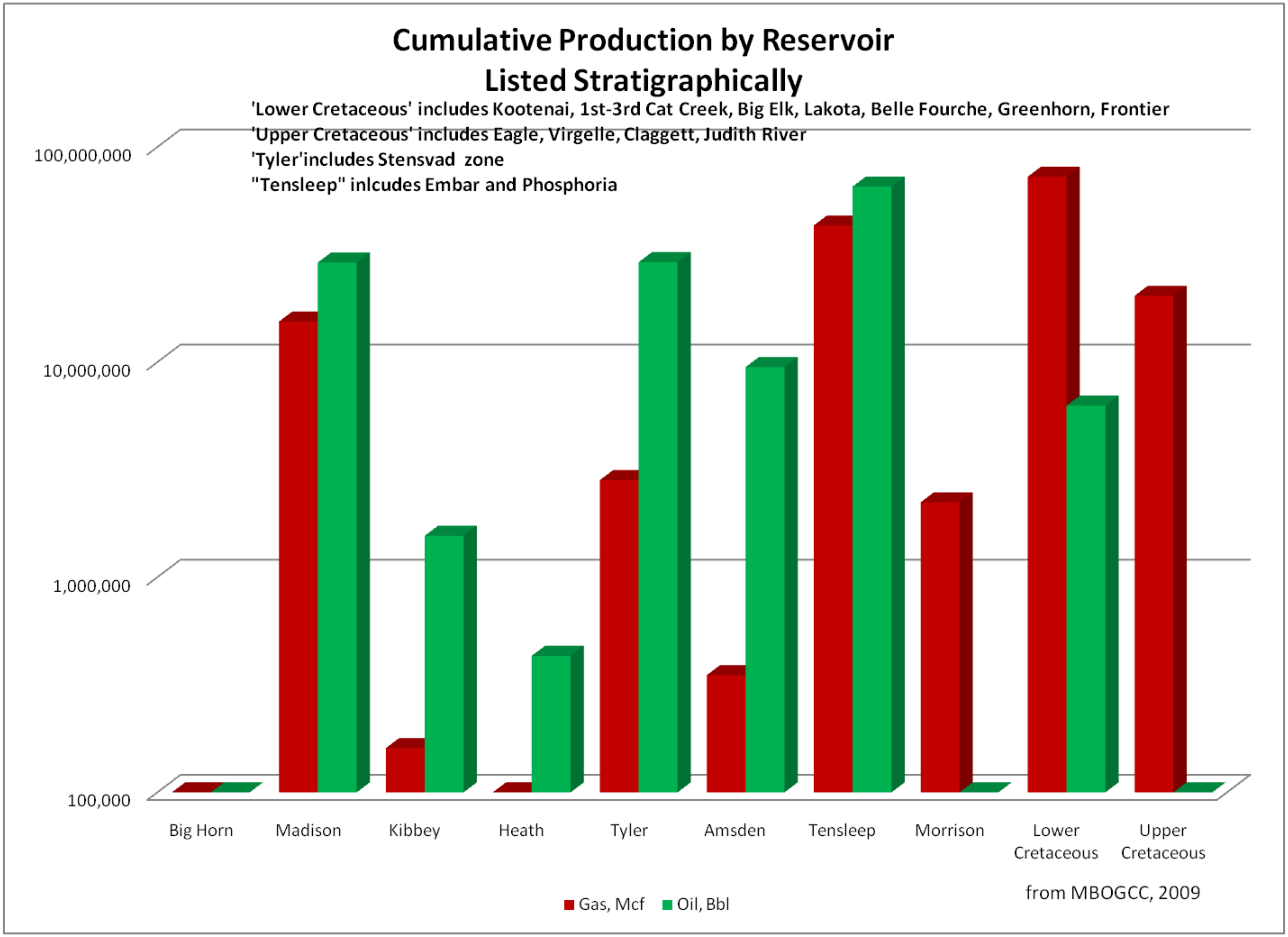


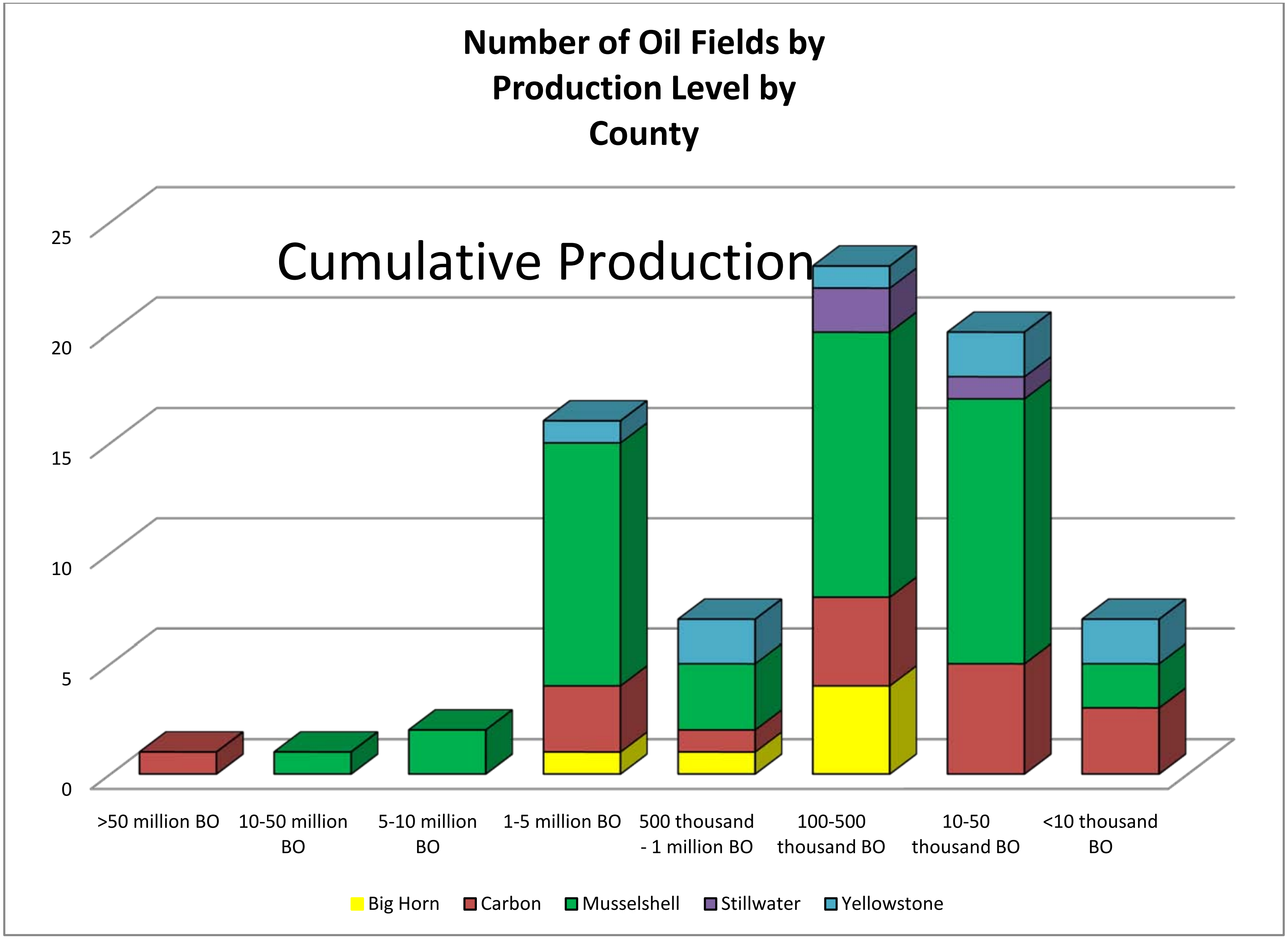
Sweet Grass County Production,
1992-2008*
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
-
*There is no oil production in the County,
and no gas production prior to 1992
data from MBOGC, 2009
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
Gas, Mcf

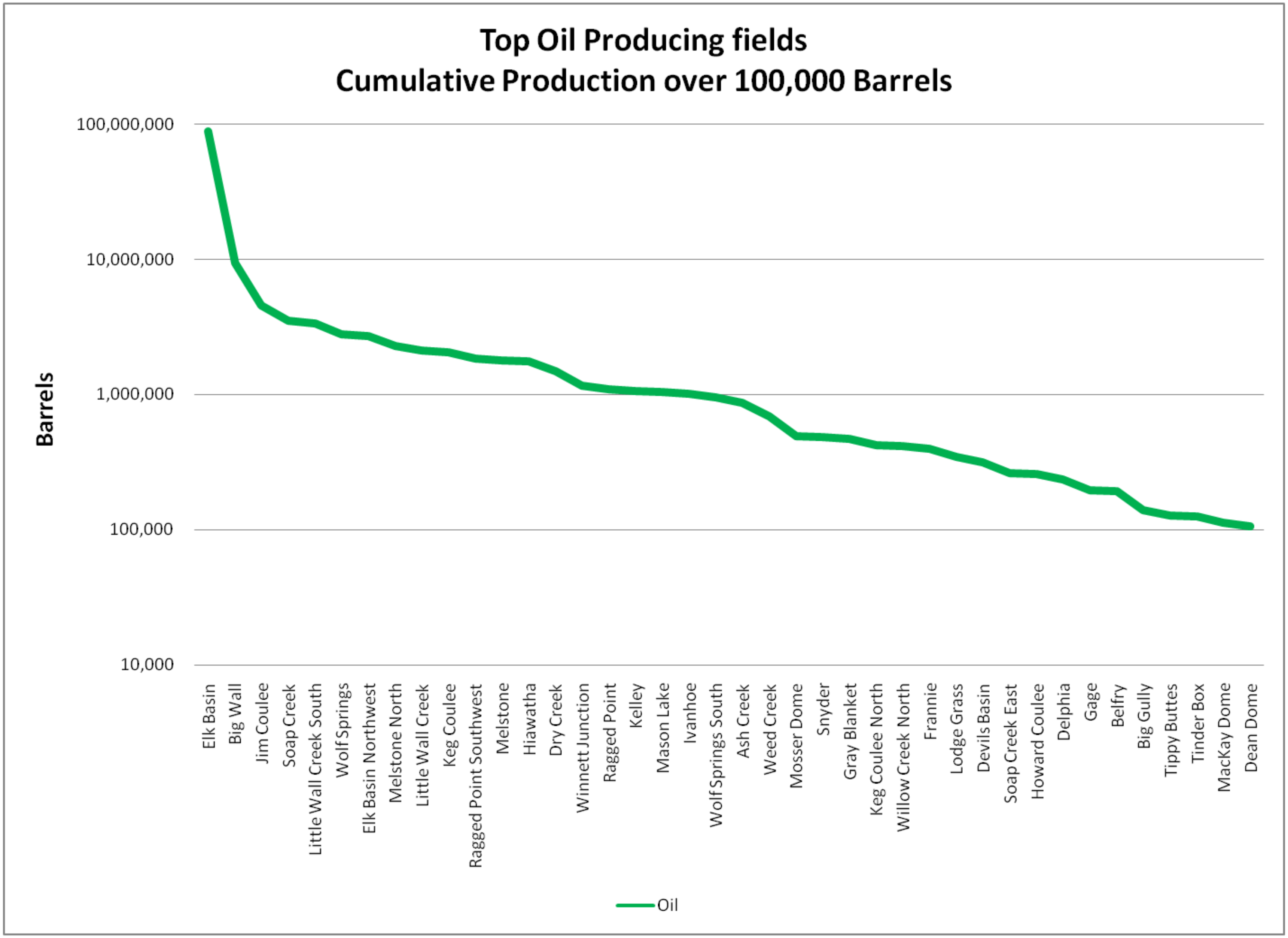


Yellowstone County Production,
1986-2008
350,000
300,000
250,000
200,000
150,000
100,000
50,000
-
1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
MBOGCC, 2009
Oil, Bbl
Gas, Mcf

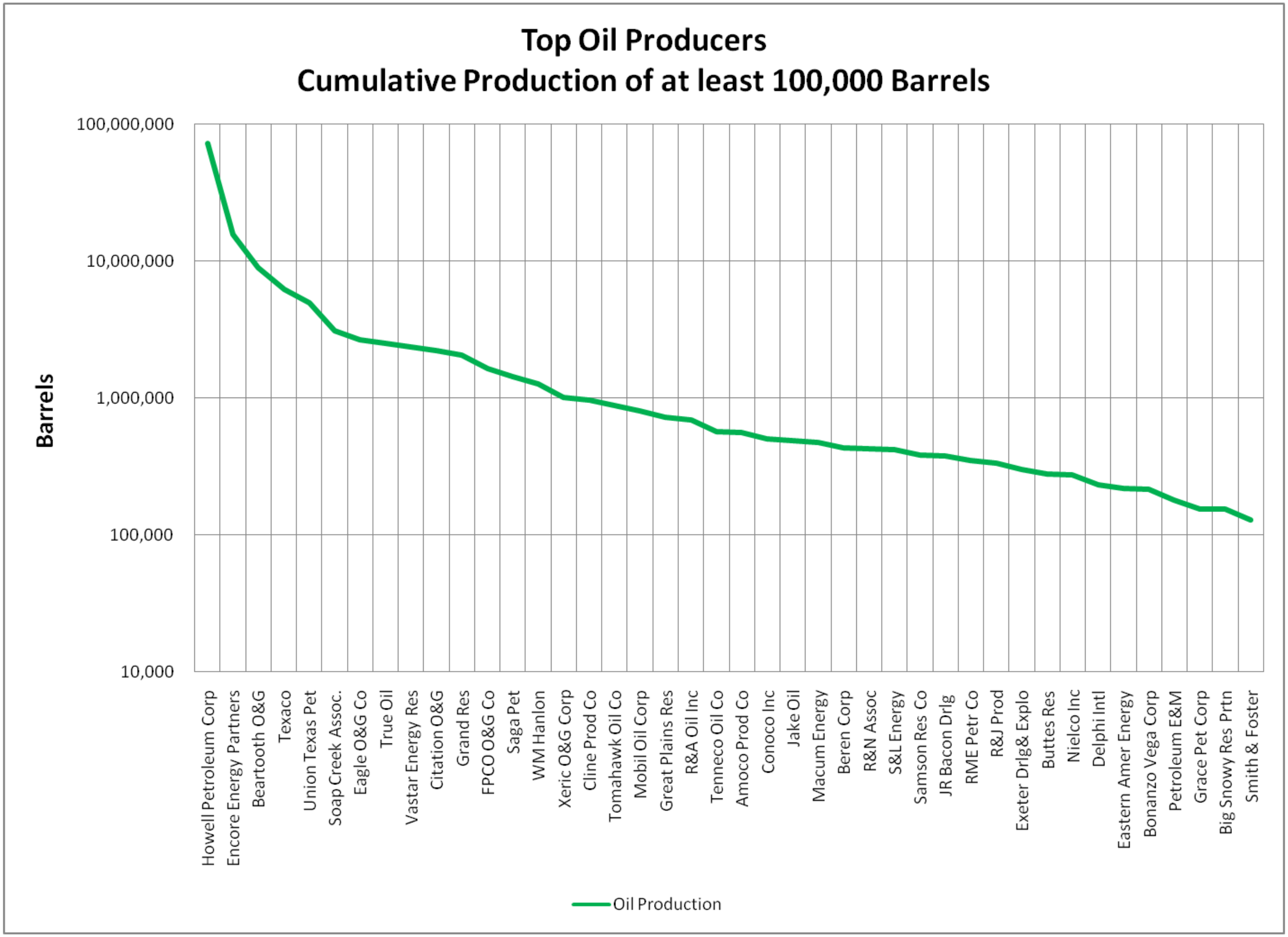

Cumulative Fluid Production By County
300,000,000
250,000,000
200,000,000
150,000,000
100,000,000
50,000,000
0
BIG HORN Total
CARBON Total
GOLDEN VALLEY Total
MUSSELSHELL Total
STILLWATER Total
SWEET GRASS Total
YELLOWSTONE Total
Gas, Mcf
Oil, Bbl
Water, Bbl

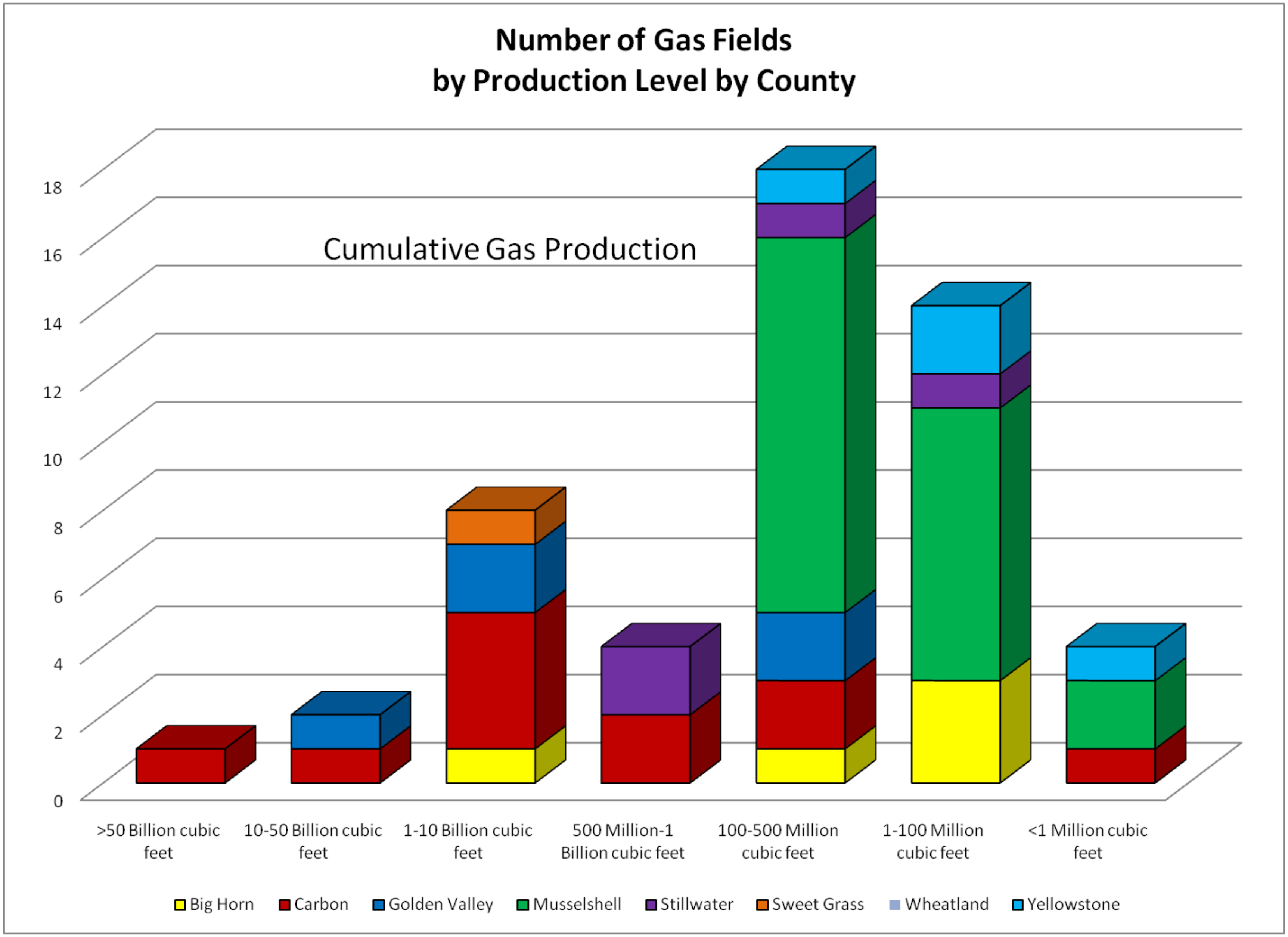

Cumulative Production by Reservoir
Listed Stratigraphically
'Lower Cretaceous' includes Kootenai, 1st-3rd Cat Creek, Big Elk, Lakota, Belle Fourche, Greenhorn, Frontier
'Upper Cretaceous' includes Eagle, Virgelle, Claggett, Judith River
'Tyler'includes Stensvad zone
"Tensleep" inlcudes Embar and Phosphoria
100,000,000
10,000,000
1,000,000
100,000
Big Horn
Madison
Kibbey
Heath
Tyler
Amsden
Tensleep
Morrison
Lower Cretaceous
Upper Cretaceous
Gas, Mcf
Oil, Bbl
from MBOGCC, 2009

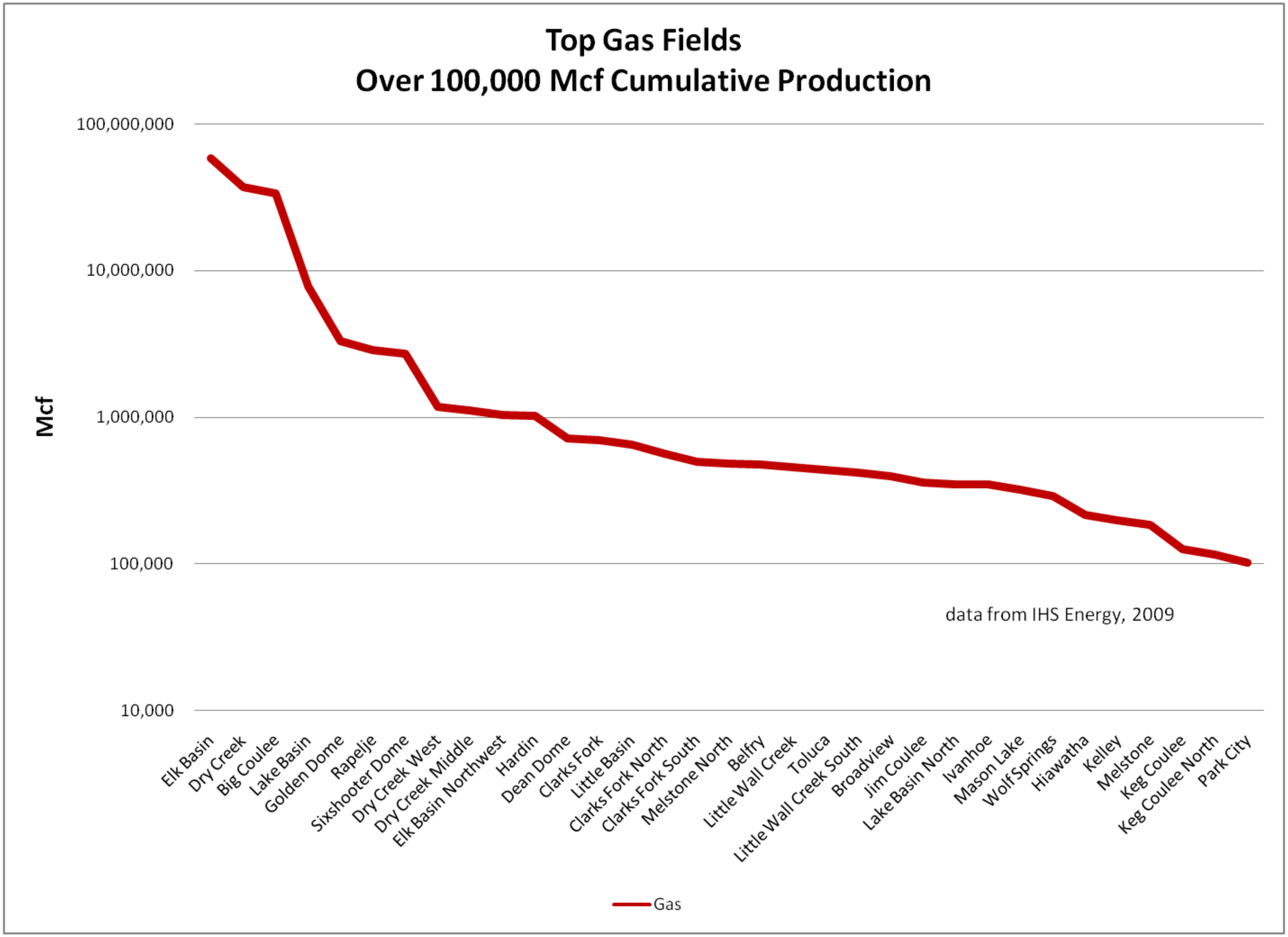

Number of Oil Fields by
Production Level by
County
Cumulative Production
25
20
15
10
5
0
>50 million BO
10-50 million BO
5-10 million BO
1-5 million BO
500 thousand - 1 million BO
100-500 thousand BO
10-50 thousand BO
<10 thousand BO
Big Horn
Carbon
Musselshell
Stillwater
Yellowstone

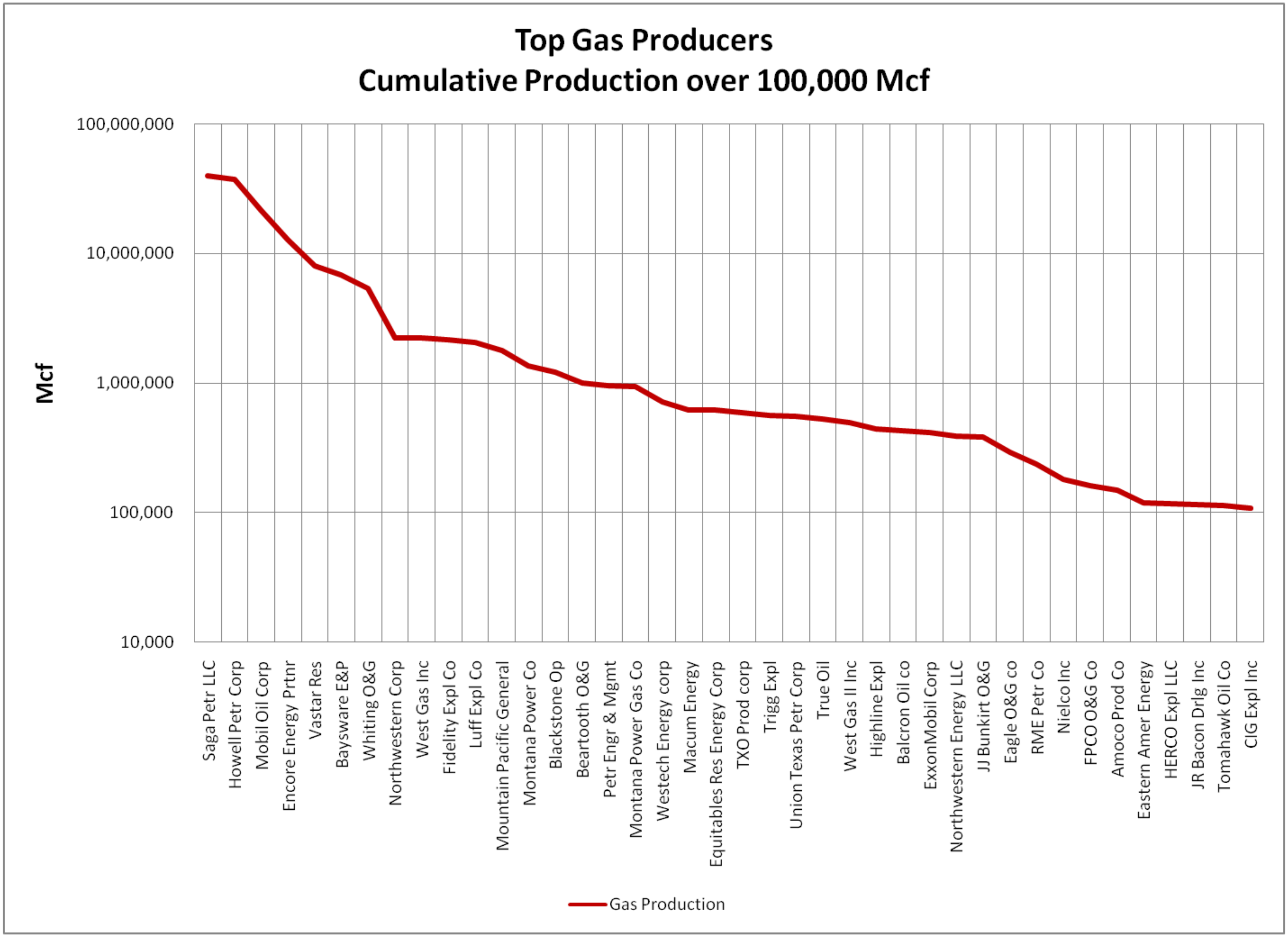


Top Oil Producing fields
Cumulative Production over 100,000 Barrels
100,000,000
10,000,000
1,000,000
100,000
10,000
Barrels
Elk Basin
Big Wall
Jim Coulee
Soap Creek
Little Wall Creek South
Wolf Springs
Elk Basin Northwest
Melstone North
Little Wall Creek
Keg Coulee
Ragged Point Southwest
Melstone
Hiawatha
Dry Creek
Winnett Junction
Ragged Point
Kelley
Mason Lake
Ivanhoe
Wolf Springs South
Ash Creek
Weed Creek
Mosser Dome
Snyder
Gray Blanket
Keg Coulee North
Willow Creek North
Frannie
Lodge Grass
Devils Basin
Soap Creek East
Howard Coulee
Delphia
Gage
Belfry
Big Gully
Tippy Buttes
Tinder Box
MacKay Dome
Dean Dome
Oil


Top Oil Producers
Cumulative Production of at least 100,000 Barrels
Barrels
100,000,000
10,000,000
1,000,000
100,000
10,000
Howell Petroleum Corp
Encore Energy Partners
Beartooth O&G
Texaco
Union Texas Pet
Soap Creek Assoc.
Eagle O&G Co
True Oil
Vastar Energy Res
Citation O&G
Grand Res
FPCO O&G Co
Saga Pet
WM Hanlon
Xeric O&G Corp
Cline Prod Co
Tomahawk Oil Co
Mobil Oil Corp
Great Plains Res
R&A Oil Inc
Tenneco Oil Co
Amoco Prod Co
Conoco Inc
Jake Oil
Macum Energy
Beren Corp
R&N Assoc
S&L Energy
Samson Res Co
JR Bacon Drlg
RME Petr Co
R&J Prod
Exeter Drlg& Explo
Buttes Res
Nielco Inc
Delphi Intl
Eastern Amer Energy
Bonanzo Vega Corp
Petroleum E&M
Grace Pet Corp
Big Snowy Res Prtn
Smith & Foster
Oil Production


Number of Gas Fields
by Production Level by County
Cumulative Gas Production
0
2
4
6
8
10
12
14
16
18
>50 Billion cubic feet
10-50 Billion cubic feet
1-10 Billion cubic feet
500 Million-1 Billion cubic feet
100-500 Million cubic feet
1-100 Million cubic feet
<1 Million cubic feet
Big Horn
Carbon
Golden Valley
Musselshell
Stillwater
Sweet Grass
Wheatland
Yellowstone


Top Gas Fields
Over 100,000 Mcf Cumulative Production
Mcf
100,000,000
10,000,000
1,000,000
100,000
10,000
data from IHS Energy, 2009
Elk Basin
Dry Creek
Big Coulee
Lake Basin
Golden Dome
Rapelje
Sixshooter Dome
Dry Creek West
Dry Creek Middle
Elk Basin Northwest
Hardin
Dean Dome
Clarks Fork
Little Basin
Clarks Fork North
Clarks Fork South
Melstone North
Belfry
Little Wall Creek
Toluca
Little Wall Creek South
Broadview
Jim Coulee
Lake Basin North
Ivanhoe
Mason Lake
Wolf Springs
Hiawatha
Kelley
Melstone
Keg Coulee
Keg Coulee North
Park City
Gas


Top Gas Producers
Cumulative Production over 100,000 Mcf
100,000,000
10,000,000
1,000,000
100,000
10,000
Mcf
Saga Petr LLC
Howell Petr Corp
Mobil Oil Corp
Encore Energy Prtnr
Vastar Res
Baysware E&P
Whiting O&G
Northwestern Corp
West Gas Inc
Fidelity Expl Co
Luff Expl Co
Mountain Pacific General
Montana Power Co
Blackstone Op
Beartooth O&G
Petr Engr & Mgmt
Montana Power Gas Co
Westech Energy corp
Macum Energy
Equitables Res Energy Corp
TXO Prod corp
Trigg Expl
Union Texas Petr Corp
True Oil
West Gas II Inc
Highline Expl
Balcron Oil co
ExxonMobil Corp
Northwestern Energy LLC
JJ Bunkirt O&G
Eagle O&G co
RME Petr Co
Nielco Inc
FPCO O&G Co
Amoco Prod Co
Eastern Amer Energy
HERCO Expl LLC
JR Bacon Drlg Inc
Tomahawk Oil Co
CIG Expl Inc
Gas Production

Marginal Wells

The following information is excerpted from the 2008 Report on marginal wells published by the Interstate Oil and Gas Compact Commission (IOGCC). The IOGCC defines marginal or stripper wells as wells that are producing no more than 10 barrels of oil per day, or no more than 60,000 cubic feet per day (60 Mcf) of natural gas.

Low-volume oil and gas wells, known as "marginal" or "stripper" wells, contribute an important percentage of the hydrocarbons produced in the U.S. most marginal wells started their productive life producing much greater volumes using natural pressure. Over time, the pressure decreases and production drops. Often, the volume of water produced along with the hydrocarbons increases, thus increasing the operating costs.

These wells still represent a large volume of reserves. In 2007, there were approximately 396,000 marginal oil wells, which produced over 291 million barrels of oil -- nearly 28 percent of total U.S. oil production. The IOGCC (2008) estimated that there were over 322,000 marginal gas wells in the U.S., producing over 1.7 trillion cubic feet of natural gas – about 11 percent of domestic production. A major concern of the IOGCC (and the BLM) is retaining the profitability of the stripper wells so production can be maintained and the reserves will not be lost if wells are prematurely plugged and abandoned. During the period from 1986-1992, when oil and gas prices were lower, the BLM initiated policies that allowed operators to shut in their marginal wells to prevent premature abandonment. The BLM later introduced a regulation (43 CFR 3103.4-2) that reduced the royalty rate on stripper oil properties, as long as the price of oil remained below $25.00 per barrel. Royalty reduction terminated in 2006, when the price of oil rose above $25.00 for the six-month period provided in the regulation.

Because the wells have low production rates and relatively high operating costs, the majority of marginal wells are owned, maintained, and produced by independent operators rather than integrated exploration and production firms which operate globally. These independent operators account for a large proportion of the jobs and corresponding economic growth associated with the petroleum industry in this country (Duda and Covatch, 2005). The IOGCC (2007) estimates in that in 2006, nine jobs were created for every $1.26 million of marginal oil and gas production. In addition, as long as these wells remain productive there are additional opportunities to use advanced technology to enhance recovery. It is generally not economical to re-enter a well once it has been plugged and abandoned.

Oil

In 2007, Montana ranked 17th of the states in the number of marginal oil wells, and 16th in marginal well production (IOGCC, 2008). In 2007, there were 2,532 marginal oil wells in Montana. These wells produced over 2 million BO; marginal well production amounted to approximately 6 percent of total Montana crude oil production (IOGCC, 2008). From 2004 to 2007, the number of marginal oil wells in Montana increased by about 8 percent, to over 4,900 wells, with over 31 billion cubic feet of natural gas produced. Within the BiFO, most of the wells are marginal producers.

Natural Gas

In 2007, Montana ranked 14th of the 28 major producing states both in the number of marginal gas wells, and marginal gas production (IOGCC, 2008). From 2004 to 2007, the number of marginal gas wells in Montana increased by about 20 percent, to over 4,900 wells, with over 31 billion cubic feet of natural gas produced – about one-third of all gas production in the state. In 2006, the state of Montana received over $1.3 million in marginal oil production tax revenue, and over $19 million in marginal gas production revenues (IOGCC, 2007).

A 2007 report by the Energy Information Administration (EIA) stated that marginal oil production represented about 28 percent of domestic production outside of Alaska, and about 4 percent of total U.S. demand. Likewise, marginal gas production represented about 7.7 percent of domestic demand.

Oil Gravity; gas characteristics; carbon dioxide (CO_2); hydrogen sulfide (H_2S); Helium byproducts; gas/oil ratios

Oil gravity varies considerably across the area. The USGS has defined two oil ‘families’ in the Big Horn Basin (Kirschbaum, 1999). Oils with low API gravity and low to moderate sulfur content were interpreted to be from a Permian Phosphoria formation source. Those oils with higher gravities and low sulfur content were interpreted to be from several Cretaceous and Tertiary sources. For example, Amsden production (Delphia, Gage, Mason Lake and Wolf Creek Fields) ranges from 30.1^o to 34.7^o. Embar/Tensleep production in Elk Basin averages about 28^o API. Heath Formation oils in the Central Montana Uplift ranges from less than 26 to 28^o. Tyler production in the Central Montana Uplift ranges from less than 31^o to 38^o. Dakota production in the Laurel and Crooked Creek Fields has an API gravity of 46^o to 47^o. Cat Creek production (Mason Lake Field) ranges from 39^o to as high as 47^o.

Most of the gas production is ‘sweet’ – with no H_2S. Madison Formation production in the Elk Basin and Frannie fields is ‘sour’. The H_2S is removed from the oil and gas prior to transportation to a refinery or gas plant. Helium is not known to exist in any of the gas streams. Overall, the oil fields produce little or no associated gas; gas/oil ratios average from 100 to 300 cubic feet per barrel of oil. There are no known CO_2 reservoirs within the BiFO.

Oil and gas prices, finding and development costs

New technologies will allow companies to target higher-quality prospects and improve well placement and success rates. As a result, fewer drilled wells will be needed to find a new trap, and total production per well will increase (U.S. Department of Energy, 1999). Also, drilling fewer wells will reduce surface disturbance and volumes of waste, such as drill cuttings and drilling fluids. An added benefit of improved remote sensing technology is the ability to identify oil and gas "seeps" from leaking wells, so that they can be cleaned up. Natural seeps can also help pinpoint undiscovered oil and gas.

Technological improvements have also cut the average cost of finding oil and gas reserves in the United States. Finding costs are the costs of adding proven reserves of oil and natural gas via exploration and development activities and the purchase of properties that might contain reserves. U.S. Department of Energy (1999) estimated finding costs were approximately $2 to 16 per barrel of oil equivalent (BOE) in the 1970's. Finding costs dropped to $4 to 8 per BOE in the 1993 to 1997 period. Since that time finding costs have fluctuated around the higher end of this range. During the 2003 to 2005 period, finding costs were $7.05 per BOE and they increased by over 60 percent to $11.34 per BOE for the 2004 to 2006 period (Energy Information Administration, 2007a). Most of this increase was reported to have come from a rise in exploration and development spending, which was amplified by a drop in reserves found. Producers have been willing to spend more to find oil and gas since prices received during this period have been higher.

Once hydrocarbons have been found, acquired, and developed for production, the expense of operating and maintaining wells and related equipment and facilities is tracked. This cost is referred to as a 'lifting' or production cost. In 2006, lifting costs in the U.S. were $9.69 per BOE, which was an increase of 22 percent from the 2005 cost of $7.94 per BOE (Energy Information Administration, 2007a). Lifting costs have increased in recent years because more producers are willing to spend more to produce oil and natural gas when their selling prices are higher.

Yearly and cumulative oil and gas production rates illustrate historical volume rates and cumulative volumes of oil and gas as a function of time through June, 2009 (IHS Energy Group, 2009; MBOGC, 2009). The changing shapes of these curves are the result of both market forces and declining reserves -- the same market forces that have impacted all production everywhere in the world. Supply and demand affect the price paid for the hydrocarbon products. While the price paid for oil and gas are generally established nationally and even internationally, local conditions such as product quality, as well as access to pipelines and refineries/gas plants, can affect the local prices offered.

Historically, producers primarily only had an interest in oil. Until perhaps the 1950s, operators who discovered natural gas generally plugged and abandoned those wells because there was no demand for natural gas.

This changed with the 1973 Oil Crisis and the raised consciousness of the impact of oil on the environment. The Arab members of the Organization of Petroleum Exporting Countries, reduced oil supply which created a worldwide oil shortage. As a result, exploration activity increased in the United States, and after a lag of several years, production began to increase. Conservation, alternative energies, and numerous other interacting factors eventually resulted in a glut of oil. With the glut of oil came a sharp market correction in oil price from a high of about $40 per barrel in 1981 to about $10 per barrel in 1986.

The impact of inflation on the costs associated with producing oil combined with cheap oil imports resulted in a contraction and restructuring of the oil business in the United States beginning in the middle 1980s. Small producers operating in isolated areas, such as the Billings

Field Office, were forced to sell off or shut in existing production. Many operators in the Rockies were selling properties and heading offshore in the Gulf of Mexico, taking advantage of royalty relief incentives to find and produce hydrocarbons in deep water.

The fast-growing economies of China and India have required the two countries to import huge volumes of hydrocarbons. This increased demand for oil caused significant increases in the price of oil from 2002 through mid-2008, when the price for oil peaked at over $140.00 per barrel. A worldwide recession commenced in late 2007; by mid-2008, reduced demand for oil and gas resulted in another glut which caused a precipitous drop in prices. Oil price fell to less than $50.00 per barrel by the end of 2008; it is currently fluctuating between $60.00 and $70.00 per barrel (June, 2009). Methane, which had approached $10.00 per Mcf, is now about $2.50 to $3.00 per Mcf.

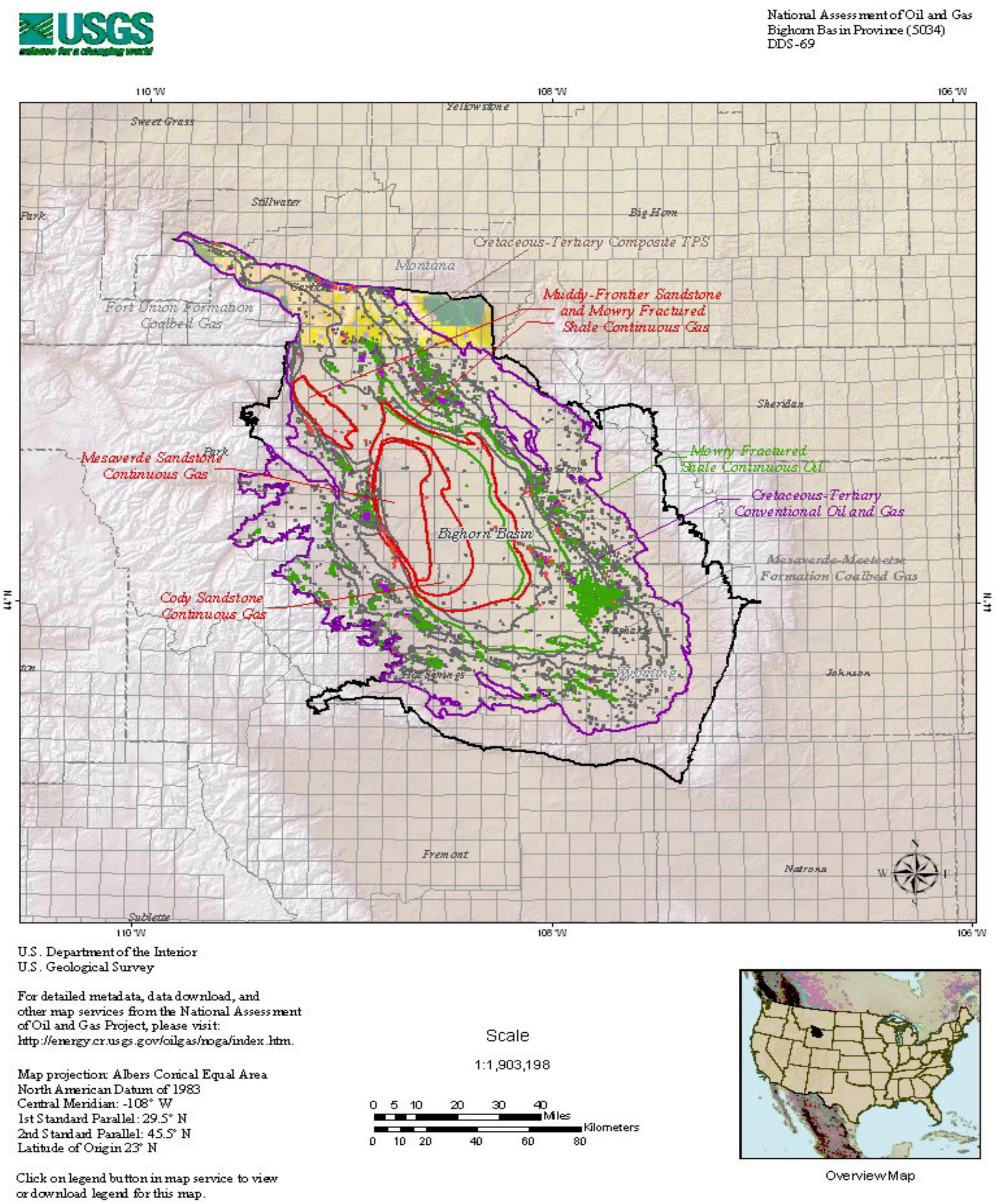
Future fluid mineral development potential

Overview

The United States Geological Survey (USGS) has assessed undiscovered oil and gas resources in the Big Horn Basin of Montana and Wyoming (Kirschbaum, 1999) and undiscovered biogenic gas resources of the North-Central Montana Province (Ridgeley, 2000). The assessments considered both conventional resources (in structural and stratigraphic traps) and unconventional resources (described as being "large spatial dimensions and indistinctly defined boundaries, and which exist more or less independently of the water column"). The assessments were based upon a "strategy for estimating volumes of undiscovered petroleum (oil, gas, and co-products) having the potential to be added to reserves in a 30-year forecast span".

For the Big Horn Basin assessment, the USGS identified two conventional and six unconventional assessment units. The assessment units that do not occur within the Billings Field Office are in italics:

- Conventional
    - Phosphoria Total Petroleum System (TPS), Paleozoic-Mesozoic O&G Assessment Unit (AU)
    - Cretaceous-Tertiary Composite TPS, Cretaceous-Tertiary O&G AU
- Unconventional
    - Cretaceous & Tertiary Composite TPS, Muddy-Frontier Sandstone and Mowry Fractured Shale Gas AU
    - *Cretaceous & Tertiary Composite TPS, Mowry Fractured Shale Oil AU*
    - *Cretaceous & Tertiary Composite TPS, Cody Sandstone Gas AU*
    - *Cretaceous & Tertiary Composite TPS, Mesaverde Sandstone Gas AU*
    - Cretaceous & Tertiary Composite TPS, Mesaverde-Meeteetsee Formation Coalbed Gas
    - Cretaceous & Tertiary Composite TPS, Fort Union Formation Coalbed Gas AU



As is apparent from this composite map prepared from U.S.G.S. data, several of the Assessment Units do not extend into the Billings Field Office. Also, only a small portion of the Big Horn Basin extends into Montana. Individual oil and/or gas 'cells' within the Big Horn Basin are sections of land with established oil and/or gas production (active or inactive).

The assessment states that "*most of the conventional petroleum traps in the Bighorn Basin are anticlinal traps and few of these structures remain untested by drilling. New conventional resource potential is interpreted to be from stratigraphic traps mainly in carbonate mounds in the Permian Park City Formation and in sandstone stratigraphic pinch-out traps in the Upper Cretaceous Frontier Formation and Cody Shale*."

For the North-Central Montana Biogenic Gas assessment, the USGS identified six conventional assessment units. The assessment units that do not occur within the Billings Field Office are in italics:

- Judith River Formation AU
- Eagle Sandstone and Claggett Shale East AU
- Eagle Sandstone and Claggett Shale West AU
- Niobrara-Carlile AU
- Greenhorn-Lower Belle Fourche AU
- Greenhorn-Upper Belle Fourche AU
- *Bowdoin Dome AU*

The USGS assessments provide an estimated volume of the resource at the '95% confidence' level, '50% confidence' level, '5% confidence' level, and the 'mean' value. In the BHB, the mean value of undiscovered oil resources was estimated at 72 million barrels; the mean value of undiscovered natural gas resources was estimated at 989 billion cubic feet. In the north-Central Montana Province, the mean value of biogenic gas resources was estimated at 6,192 billion cubic feet.

However, it is important to understand that these volumes are based upon the <u>full extent</u> of the AUs, and only a small portion of the BHB area is in Montana. Likewise, the biogenic gas resources are based upon the <u>full extent</u> of the AUs in North-Central Montana, and only a small portion of this province is within the Billings Field Office.

<u>Billings Field Office</u>

Oil and gas activity within the BiFO is cyclical, and generally dispersed. However, if a new field is discovered (or production in a new horizon within an existing field), it is likely that operators will concentrate their drilling activity within that area until the economic or geological limits of the reservoir have been determined. Also, as the field limits are reached, and the reservoir characteristics are better understood, operators may request approval for increased density (infill) drilling to access bypassed oil and gas and increase field recovery.

If secondary recovery operations are initiated in a field, additional wells may be drilled, and existing wells may be converted, into injection wells. This often requires additional infrastructure, (i.e., roads, tanks, pipelines and compressors).

In the last 20 years, there have been 341 wells drilled within the BiFO (an average of 17 wells per year). The total number of wells drilled range from 10-25 per year (and most counties had fewer than 8 wells drilled per year). In 2008, 33 wells were drilled in Big Horn County alone. All were drilled within the Toluca Gas field, extending production in the Belle Fourche Formation.

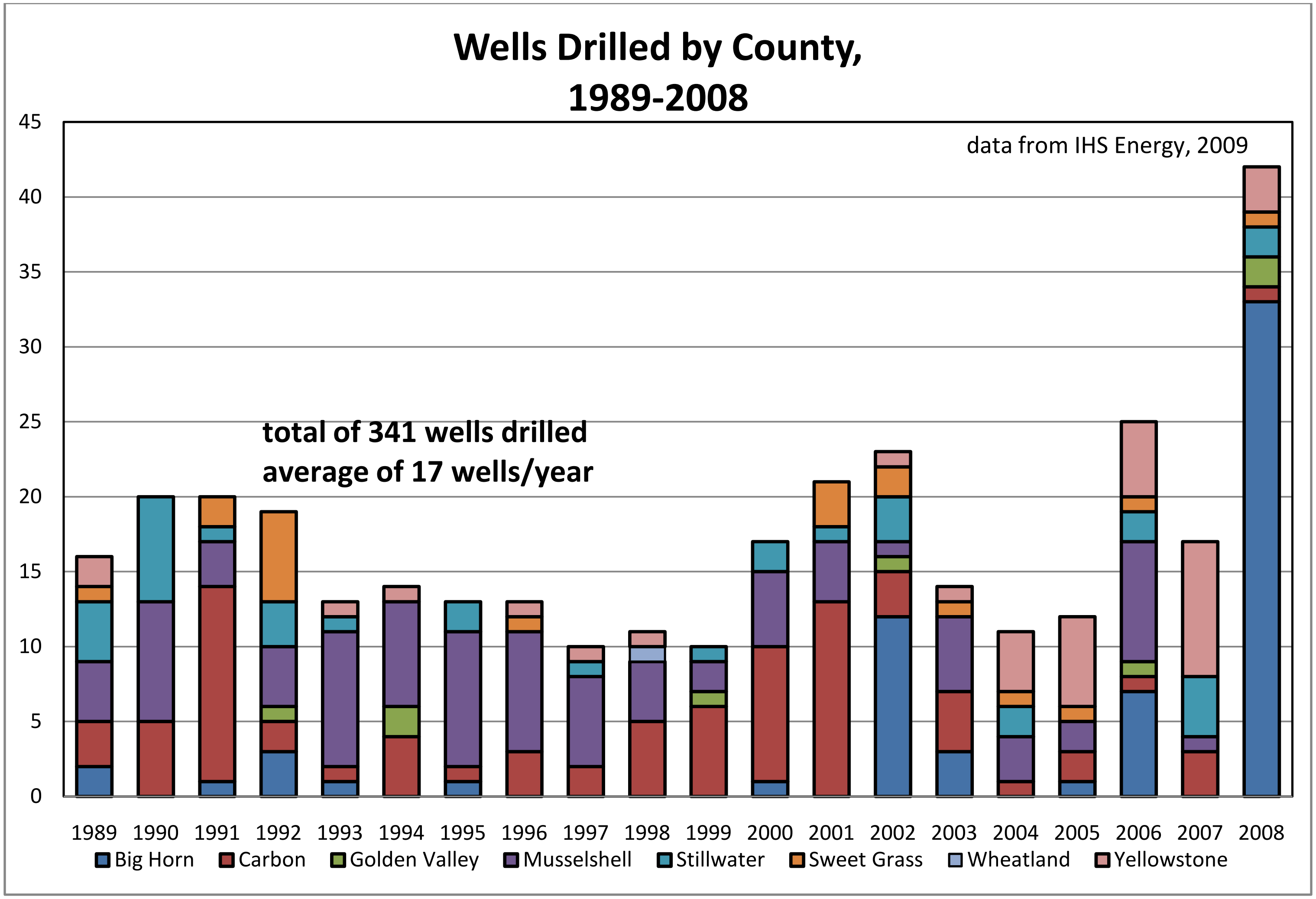
Besides the high level of drilling in the Toluca gas field in 2008, there has been a flurry of well permitting in the area around the Hardin gas field, also in Big Horn County. The company Ursa Major, LLC (Crow O&G Company), obtained approval to drill 27 wells. It is the first new drilling in the field since the 1960s.

Of the 341 wells drilled, 171 were completed for production or as planned service wells, a 50 per cent success ratio. While this represents an average of about 9 new producing wells each year, 38 of the producing wells were completed in 2008 alone (nearly 24 percent of the producing wells), and most were located within the Toluca Gas field.

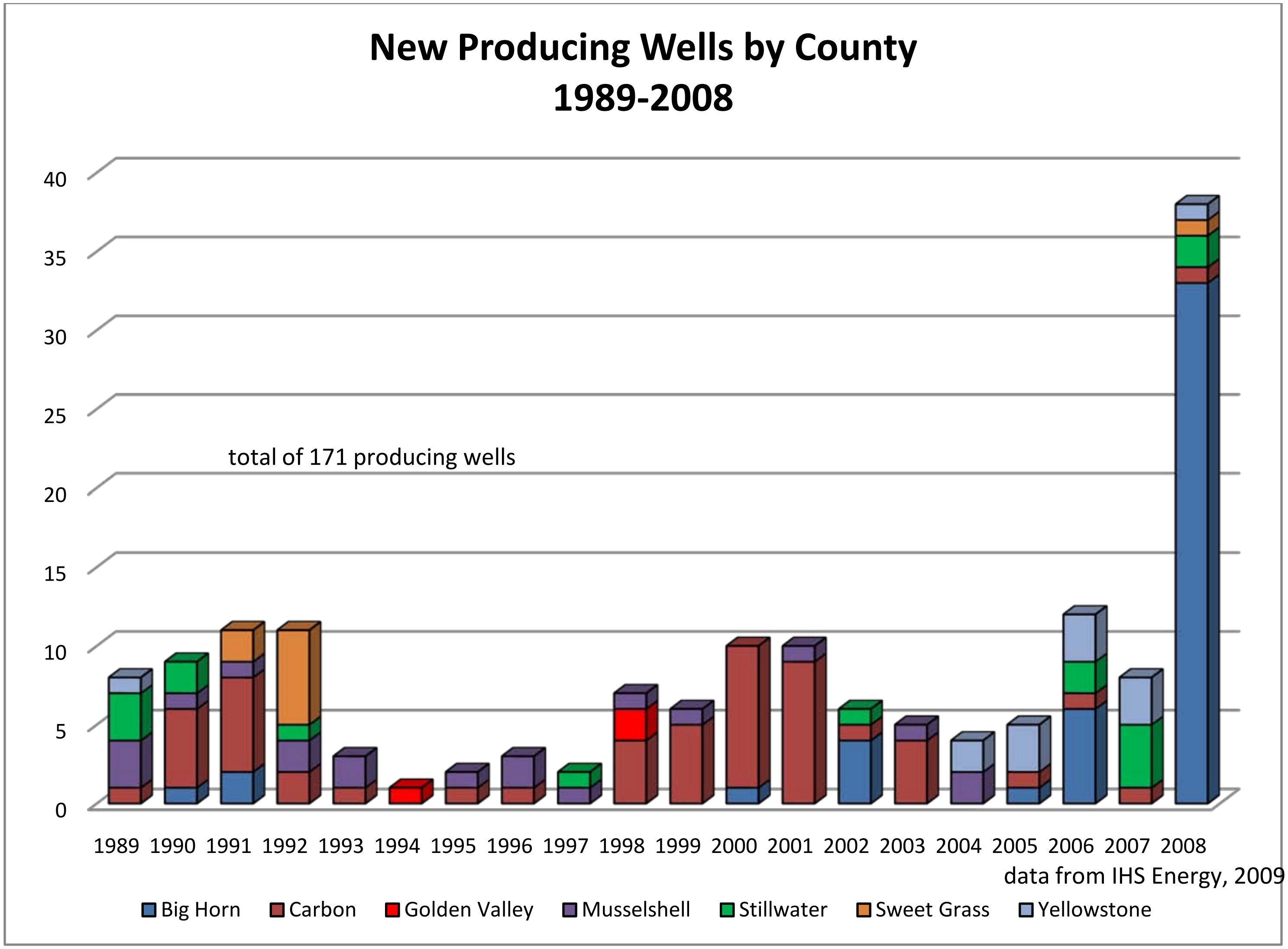
As stated earlier in this document, there is only one new play within the BiFO. Several operators are exploring for natural gas in Cretaceous shales in the Crazy Mountains Basin. To date, the operators have had mixed success. They have recovered significant gas flows, but several of the wells have produced high volumes of water as well. In addition, drilling and completion costs are very high, require significant volumes of water, and there is no nearby pipeline connection to market the gas. With the current (2009) low price for natural gas, it appears that the operators are cutting back on their drilling programs.

There is potential for the drilling of CBNG wells in the coal fields within the Big Horn and Bull Mountain Basins. No wells have been drilled for CBNG since 1991, when Florentine Exploration drilled four wells to test the CBNG in coals in the Red Lodge-Bearcreek area. No gas recovery from these wells was reported.

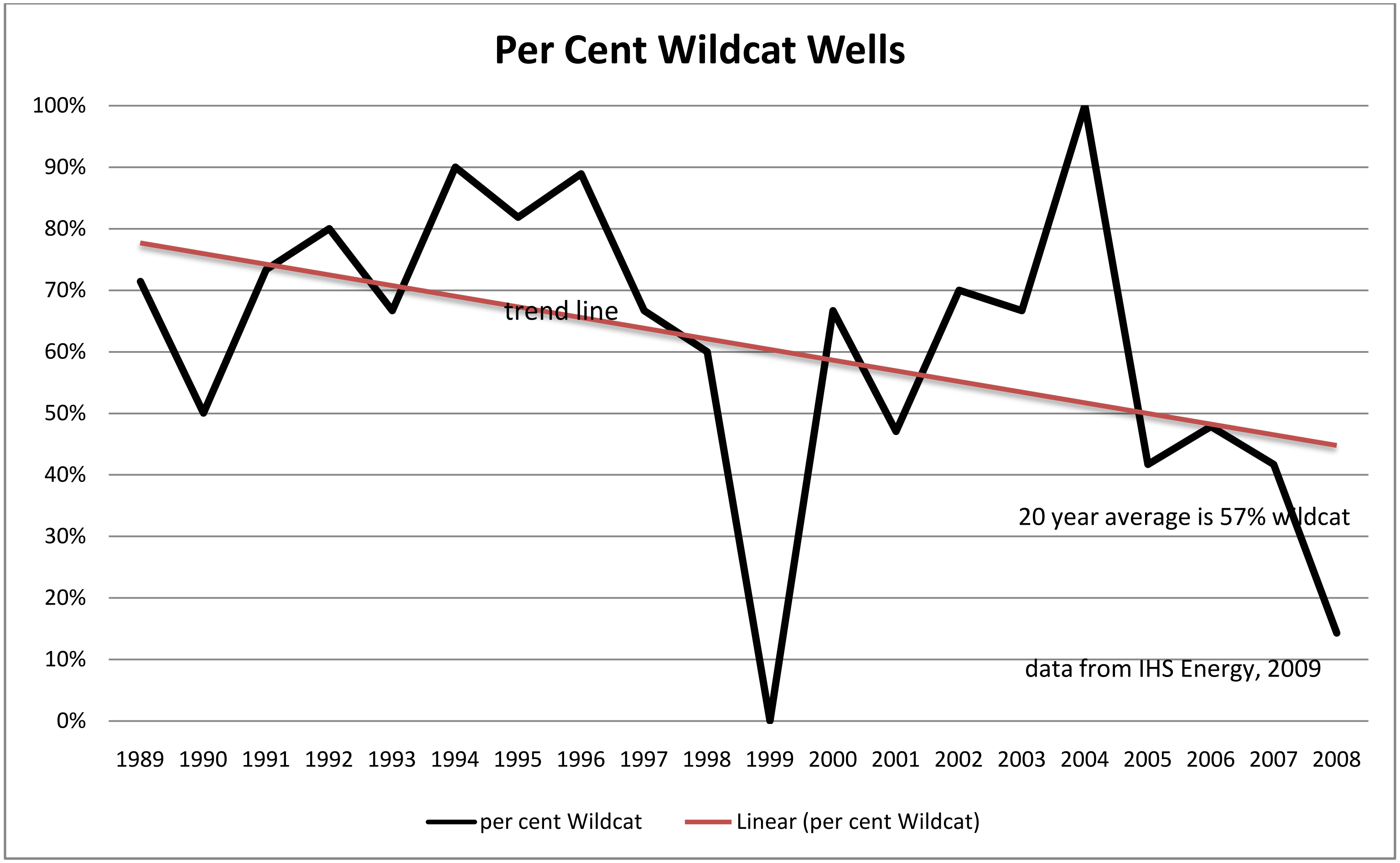
It is likely that there will be further drilling for CBNG when the price of natural gas again increases. Development potential is unknown. The BLM believes that CBNG drilling and development would be similar to conventional shallow well drilling. The well pad and access needs are estimated at 3½ acres per well.

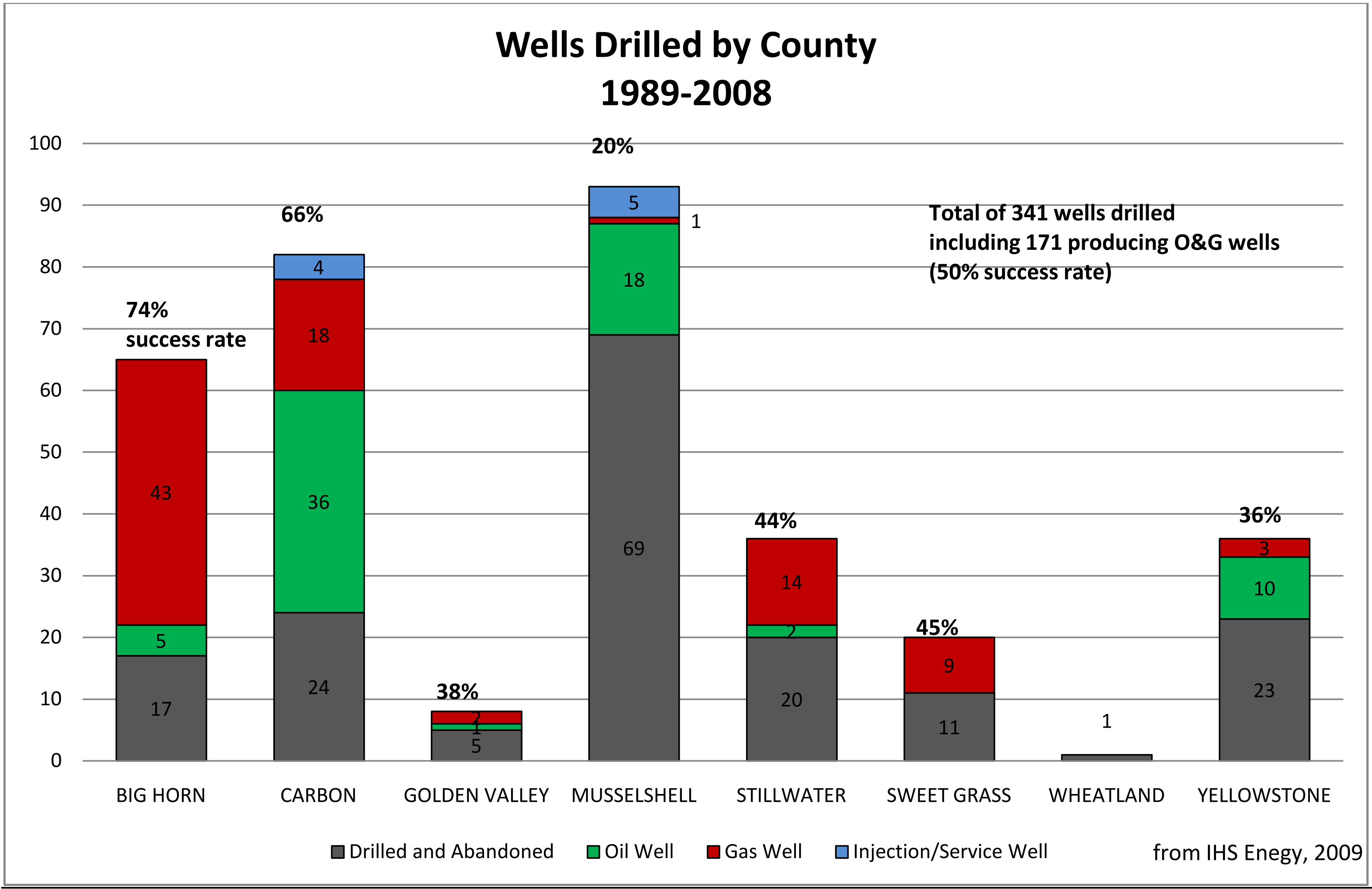


Wells Drilled by County,
1989-2008
data from IHS Energy, 2009
total of 341 wells drilled
average of 17 wells/year
0
5
10
15
20
25
30
35
40
45
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Big Horn
Carbon
Golden Valley
Musselshell
Stillwater
Sweet Grass
Wheatland
Yellowstone


New Producing Wells by County
1989-2008
40
35
30
25
20
15
10
5
0
total of 171 producing wells
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
data from IHS Energy, 2009
Big Horn
Carbon
Golden Valley
Musselshell
Stillwater
Sweet Grass
Yellowstone

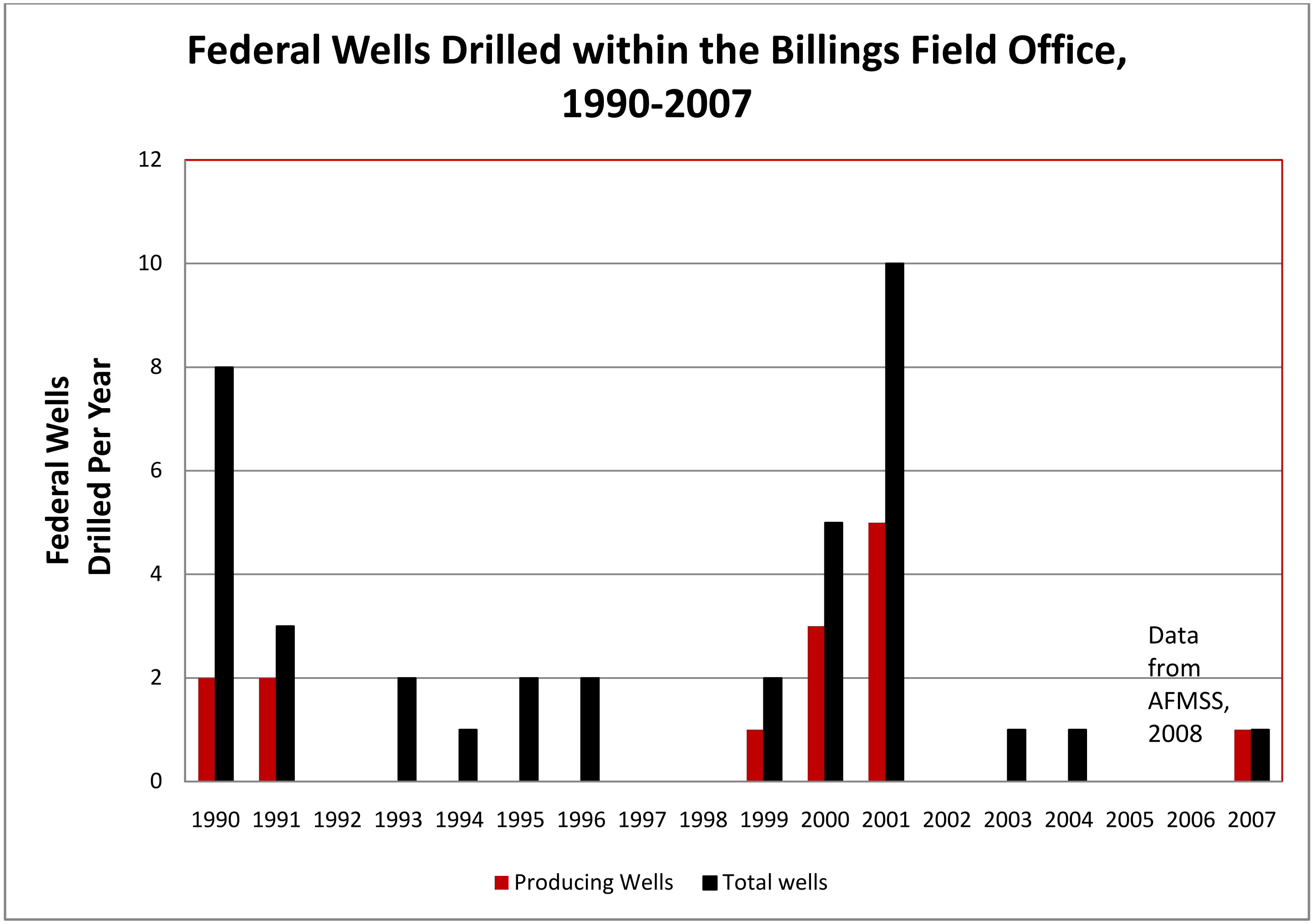
The percent of wells drilled as wildcat varied considerably over the last 20 years, but the trend is that fewer exploration wells were drilled. This downward trend is certainly influenced by the 33 development wells drilled in the Toluca field in 2008. It may shift back to a higher percentage of exploratory wells as the Crazy Mountains Basin play evolves.




Wells Drilled by County
1989-2008
100
90
80
70
60
50
40
30
20
10
0
74%
success rate
43
5
17
66%
4
18
36
24
38%
2
1
5
20%
5
1
18
69
44%
14
2
20
45%
9
11
1
36%
3
10
23
Total of 341 wells drilled
including 171 producing O&G wells
(50% success rate)
BIG HORN
CARBON
GOLDEN VALLEY
MUSSELSHELL
STILLWATER
SWEET GRASS
WHEATLAND
YELLOWSTONE
Drilled and Abandoned
Oil Well
Gas Well
Injection/Service Well
from IHS Enegy, 2009

Federal Wells

Over the same period of time, only 40 of the wells were drilled within a Federal oil and gas lease (about 12 percent of all wells drilled). Fourteen of the wells were completed for production - a 35 percent success ratio (AFMSS, 2009). Currently, there are 20 active Federal oil and gas wells within the BiFO, located within 21 distinct units, CAs or individual leases (AFMSS, 2009).



Map 1 (found in Appendix A) identifies the areas with Low or Moderate levels of forecasted drilling activity. **There are no identified areas of High forecasted drilling activity (greater than 5 wells drilled per year).** Areas of Low drilling activity are forecasted to have no more than one well drilled per township per year. Areas of Moderate drilling activity are forecasted to have between one and five wells drilled per township per year. The 'Moderate' potential areas were delineated from the extent of existing oil and gas fields, and the resource plays that may encourage further drilling activity. The 'Low' potential areas are lands that have been sparsely explored, have no established production, and are not within identified geological structures (especially surface-exposed structures that have drawn past drilling activity).

It is likely that forecast drilling activity levels will be somewhat higher than the levels of the past 20 years. For the 20 year forecast period of the RMP, The BLM anticipates an average of 20 wells to be drilled per year (versus 17 wells drilled per year from 1989-2008). Some of the new drilling will be in wildcat areas in the Crazy Mountains Basin play. There are fewer Federal minerals in Sweet Grass and Wheatland Counties than in the other counties within the Billings Field Office. Federal conventional and unconventional (including CBNG) wells will average three to four wells per year.

Anticipated surface disturbance is dependent upon the location to be drilled, the local topography, the likely product, and drilling depth. The following table is modified from the 1992 Miles City Oil and Gas EIS/RMP Amendment:

Forecast Drilling Depths, and Initial Surface Disturbance by Basin				
Location	**Common Drilling Depth in Feet**	**Likely Product**	**Size of Drill Site in Acres**	**Access and Ancillary Facilities in Acres**
Central Montana Uplift and Bull Mountain Basin CBNG	5,000	Oil with associated gas; CBNG	2	1½
Big Horn Basin conventional and CBNG	7,000	Oil with associated gas; Gas; CBNG	3	1½
Crazy Mountains Basin	8,000-10,000	Gas	4	1½

Anticipated surface disturbance is 28 acres per year (8 x 3½) in the Central Montana Uplift/Bull Mountain Basin (including Golden Valley, Musselshell and northern Yellowstone Counties); 36 acres per year (8 x 4½) in the Big Horn Basin (including Big Horn, Carbon, southern Stillwater and southern Yellowstone Counties); and 22 acres per year (4 x 5½) in the Crazy Mountains Basin (Sweet Grass and southern Wheatland Counties); for a total of 86 acres per year for calendar years 2010 through 2014.

Forecast Drilling Activity and Surface Disturbance, 2010-2014					
Location	**Size of Drill Site in Acres**	**Access and Ancillary Facilities in Acres**	**Number of Wells Drilled per Year**	**Short Term Disturbance, Acres**	**Long Term Disturbance, Acres (75% success for development wells, 25% for exploratory wells, with interim reclamation)**
Central Montana Uplift and Bull Mountain Basin CBNG	2	1½	8: 4 wildcat, 4 development	28	14
Big Horn Basin conventional and CBNG	3	1½	8: 4 wildcat, 4 development	36	18
Crazy Mountains Basin	4	1½	4: 4 wildcat	22	5½
Total annual disturbance				86	37½

Assuming that three of four development wells are successful, and one of four exploration wells, each year there will be 4 new producing wells each in the Central Montana Uplift/Bull Mountain Basin (CMU/BMB) and the Big Horn Basin (BHB), and one new gas well in the Crazy Mountains Basin (CMB). Initial surface disturbance would be 14 acres in the CMU/BMB, 18 acres in the BHB, and 5½ acres in the CMB, totaling 37½ acres for the nine producing wells. The drilling of eleven dry holes would initially disturb 48½ acres per year.

A major gas discovery in the Crazy Mountains Basin could require a significant investment in the construction of a transmission pipeline to enable processing, transportation and marketing of the gas. It is likely that a major transmission pipeline would be buried, reducing the long-term surface disturbance, but gas gathering lines and other infrastructure could create long-term disturbances.

As stated earlier in this document, a significant new discovery would result in increased and perhaps more rapid drilling as the operators attempt to define the reservoir limits and develop the field. This is especially true in the Crazy Mountains Basin, which to date has experienced so little drilling activity.

If there is a significant gas discovery here, the number of wells drilled could double to 8 wells per year. In subsequent years, the number of wells drilled per year would increase to 24; overall acres disturbed in the short-term would increase from 86 to 108 acres per year for years 2015 through 2030.

Forecast Drilling Activity and Surface Disturbance, 2015-2030					
Location	**Size of Drill Site in Acres**	**Access and Ancillary Facilities in Acres**	**Number of Wells Drilled per Year**	**Short Term Disturbance, Acres**	**Long Term Disturbance, Acres (75% success for development wells, 25% for exploratory wells, with interim reclamation)**
Central Montana Uplift and Bull Mountain Basin CBNG	2	1½	8: 4 wildcat, 4 development	28	14
Big Horn Basin conventional and CBNG	3	1½	8: 4 wildcat, 4 development	36	18
Crazy Mountains Basin	4	1½	8: 4 wildcat, 4 development	44	22
Total annual disturbance				108	54

On Federal oil and gas leases, the BLM requires interim reclamation of well pads and access roads. This will quickly reduce the initial area of surface disturbance to only that area needed to operate the well and necessary facilities. The two to three acre well pads needed for drilling and completing the well may shrink to perhaps 1-1½ acres of long-term surface disturbance. And the BLM requires that the well pads on any dry holes to be quickly re-contoured and restored. Assuming two to four Federal wells are drilled per year, surface disturbance on Federal lands (including split estates with non-Federal surface overlying Federal minerals) will be around 13½ -27 acres per year. Anticipated long-term surface disturbance would be 5½ - 15½ acres per year.

Federal Oil and Gas Wells					
Location	**Size of Drill Site in Acres**	**Access and Ancillary Facilities in Acres**	**Number of Wells Drilled per Year**	**Short Term Disturbance, Acres**	**Long Term Disturbance, Acres (75% success for development wells, 25% for exploratory wells, with interim reclamation)**
Central Montana Uplift and Bull Mountain Basin CBNG	2	1½	1-2; development	3½ - 7	2 - 5
Big Horn Basin conventional and CBNG	3	1½	1-2: development	4½ - 9	3½ - 6
Crazy Mountains Basin	4	1½	1-2; wildcat	5½ - 11	0 – 4½
Total annual disturbance				13½ - 27	5½ - 15½

The BLM does not anticipate that CBNG drilling and development would result in any different environmental impacts than conventional drilling and development. In contract to the Powder River Basin (PRB), coals in the Big Horn and Bull Mountains Basins are at greater depths. Operators would drill using conventional drilling rigs and conventional drilling techniques, so the area disturbed would be similar to conventional wells. The coal beds generally are not sources of fresh water for domestic or agricultural purposes (underground sources of drinking water). Produced water would be disposed of in a similar manner as water from conventional reservoirs – most likely reinjection into horizons bearing water of similar or lower quality. The coals are higher grade, and would have greater volumes of adsorbed CBNG than PRB coals. Because there aren't thick, stacked coal beds, there would likely be only one well drilled per well pad. For these reasons, the BLM believes it is not necessary to assess CBNG drilling separately from other drilling activity.

The Hydrologic Resources section in Chapter 3 of the October, 2008, Final Supplement to the Montana Statewide Oil and Gas Environmental Impact Statement and Proposed Amendment of the Powder River and Billings Resource Management Plans describes Water Management issues in CBNG development. The description of **Class IID Injection into Deep Non-USDW Reservoirs** would be the best analog for CBNG development within the Billings Field Office. This section states:

Class II injection wells, typically used for conventional oil and gas operations, have the potential to be used for CBNG water disposal. EPA classifies deep injection wells used for disposal below any USDW as Class II wells. Class II injection wells are subdivided as either IID (for disposal) or IIR (for secondary oil recovery).

Class IID permits are issued for injection into an underground formation that contains water with a TDS greater than 10,000 mg/L or is an exempted aquifer. These deep Class IID wells may be able to accept large volumes of water in an environmentally safe manner; however, success with these wells in the PRB has been limited, with only ~30 percent being successful (Sattler et al., 2006). Class IID injection zones typically are very deep and are isolated from drinking water sources by thick, impermeable, confining zones.

Technical parameters relating to the feasibility of deep well injection are site-specific. They primarily include a high enough porosity and permeability and low enough pressure within the deep injection zone to allow for injecting large volumes of water. Water quality of the injection zone with respect to TDS is also a factor. The distance and cost of running pipelines to injection wells and the cost of drilling the injection wells would also be factors.

It is unlikely that the produced water would be injected into a producing oil reservoir for secondary oil recovery (a Class IIR well).

Appendix A

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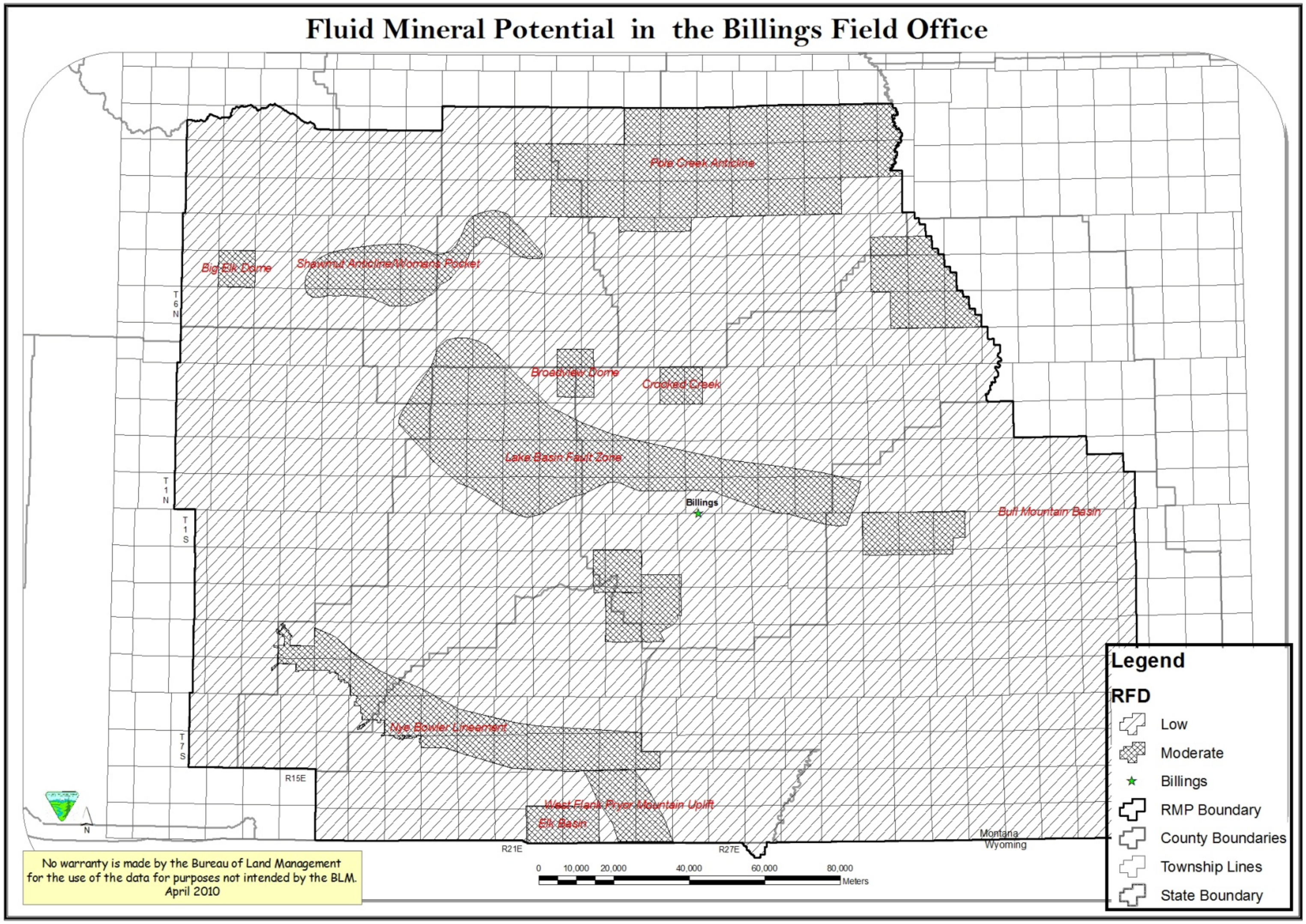
Map 1 - Fluid Mineral Potential in the Billings Field Office



Appendix B

2008 Report from the Montana Board of Oil and Gas Conservation Commission

(inactive and abandoned fields in red)

Field Name	Formation; # of Wells	Oil , Bbls	Gas, MCF	Cumulative Production And Regulation Summary MBOGC recorded gas production beginning in 1986
Ash Creek				**Cumulative Oil Production (Bbls): 868,169** Spacing waived (Shannon Formation) within unitized portion of field with wells to be no closer than 660' to unit boundary (Order 4-65). Waterflood initiated October 1964 (Orders 22-64, 15-66).
Belfry				**Cumulative Oil Production (Bbls): 101,245** **Post-1986 Gas Production (MCF): 8,760** Statewide.
Big Coulee	Big Elk. 1 3rd Cat Creek 2 Morrison 1 Lakota, Morrison 6	0 0 0 0 0	29,525 33,828 5,693 260,868 329,914	**Post-1986 Gas Production (MCF): 4,986,638** Statewide except for single spacing unit for production of gas from the Morrison Formation consisting of Sec. 29, T. 4 N., R. 20 E. (Order 25-86).
Big Gully	Tyler 1	6,191	0	**Cumulative Oil Production (Bbls): 154,566** Statewide
Big Gully, North				**Cumulative Oil Production (Bbls): 29,892** Statewide.
Big Wall	Amsden 3 Tyler 9	12,115 17,335 29,450	0 0 0	**Cumulative Oil Production (Bbls): 8,605,282** Basal Amsden Sand and Amsden Dolomite spaced by old statewide spacing; 330' from lease or property line, 990' between wells in same reservoir (Order 12-54). Waterflood of Tyler "B" sand started August 1966 (Order 22-66). A second Tyler "B" waterflood authorized by Order 96-83.
Big Wall, North				**Cumulative Oil Production (Bbls): 7,218**
Butcher Creek				**Cumulative Oil Production (Bbls): 579** 320' between producing wells with "heater" wells to be located no closer than 160' to producing wells (Order 17-60).
Clark's Fork	Greybull 1	417	20,039	**Cumulative Oil Production (Bbls): 100,678** **Post-1986 Gas Production (MCF): 514,742** 330' from quarter-quarter section line; 1,320' between wells with 75' topographic tolerance (Order 17-54).

Field Name	Formation; # of Wells	Oil, Bbls	Gas, MCF	Cumulative Production And Regulation Summary
Clark's Fork, North				**Cumulative Oil Production (Bbls): 1,024,608** Delineated for production of gas condensate from Lakota Fm.; 160-acre spacing units, 660' setback from spacing unit boundaries
Crooked Creek	Dakota 1	79	0	**Cumulative Oil Production (Bbls): 28,940** Statewide
Dean Dome	Greybull 2	0	210,371	**Cumulative Oil Production (Bbls): 92,597** **Post-1986 Gas Production (MCF): 704,623** Statewide.
Delphia	Amsden 2	397	0	**Cumulative Oil Production (Bbls): 372,199** Statewide
Devil's Basin	Tyler 1 Heath 2	588 299 887	0 0 0	**Cumulative Oil Production (Bbls): 139,368** 10-acre spacing units for Heath Formation; well location to be in the center of each spacing unit with a 75' tolerance for topographic or geologic reasons (Order 114-80). Certain lands removed from field (Orders 103-94, 64-97).
Devil's Pocket				**Cumulative Oil Production (Bbls): 53,796** 40-acre spacing units for Heath Formation; wells no closer than 165' to spacing unit boundary (Order 34-85)
Dry Creek	Eagle 2 Frontier 13 Judith River 2 Greybull 1 Judith River, Eagle 2	0 0 0 245 0 245	62,685 219,591 25,470 74,830 47,383 429,959	**Cumulative Oil Production (Bbls): 4,171,608** **Post-1986 Gas Production (MCF): 13,070,279** Field delineated for Frontier gas production with E½ or W½ of sections as spacing units (Order 8-70). West Dome gas storage project approved (Order 31-66). Enlarged (Order 69-92). Order 8-70 modified to allow N½ or S½ of section as spacing units (Order 31-76).
Dry Creek (Shallow Gas)	Judith River, Claggett, Eagle, Virgelle 1	0	154,385	**Cumulative Oil Production (Bbls): 1,180** **Post-1986 Gas Production (MCF): 1,846,556** 160-acre spacing units with 1 well per productive horizon above Cody Shale per spacing unit; location no closer than 660' to spacing unit boundaries (Order 54-76). Additional wells (Order 13-90)
Dry Creek, Middle	Eagle 1 Frontier 2	1,027 0 1,027	6,451 13,260 19,711	**Cumulative Oil Production (Bbls): 24,157** **Post-1986 Gas Production (MCF): 684,694** 320-acre spacing units for Frontier gas production consisting of two adjacent governmental quarter sections lying north-south or east-west at operator's option; permitted well no closer than 660' to spacing boundary (Order 25-75).

Field Name	Formation; # of Wells	Oil, Bbls	Gas, MCF	Cumulative Production And Regulation Summary
Dry Creek, West	Frontier 1 Greybull 1	0 0 0	84,957 4,037 89,994	**Cumulative Oil Production (Bbls): 16,444** **Post-1986 Gas Production (MCF): 1,003,542** Originally 160-acre spacing units for Greybull Sandstone; well location anywhere in spacing unit but no closer than 660' to unit boundary (Order 43-78); amended to include Frontier Formation (Order 65-82). Field enlargement (Orders 86-82, 154-04)
Elk Basin (Elk Basin Unit managed by BLM RMG, Casper, WY)	Frontier 14 Madison 16 Embar, Tensleep 27	9,697 125,893 259,366 394,956	29,037 59,664 1,104,868 1,193,569	**Cumulative Oil Production (Bbls): 91,911,311** **Post-1986 Gas Production (MCF): 10,599,743** Spacing waived within unit areas (Order 10-61). Frontier: Water injection (Order 1-72). Embar-Tensleep pressure maintenance by crestal gas injection. Waterflood approved in 1966 (Order 5-66). Madison: Water injection (Order 17-61). Frontier exception locations (Orders 35-, 36-, 37-01). Frontier spacing unit (Order 1-02)
Elk Basin, Northwest	Frontier 4 Cloverly 1 Madison 5 Embar, Tensleep 1	1,386 332 33,854 1,036 36,608	3,789 4,416 16,371 71 24,647	**Cumulative Oil Production (Bbls): 2,791,730** **Post-1986 Gas Production (MCF): 802,426** Spacing waived within unitized portion except that bottom of hole be no closer than 330' from unit boundary and there be at least 1,320' surface distance between wells in same formation; 75' topographic tolerance (Orders 43-63, 28-64). Embar-Tensleep waterflood (Order 3-67, 6-74).
Fiddler Creek	Greybull 1 Pryor Cgl 1	300 35 335	0 0 0	**Cumulative Oil Production (Bbls): 2,922** Statewide.
Frannie (Frannie Unit managed by RMG, Casper WY)				**Cumulative Oil Production (Bbls): 773,613** **Post-1986 Gas Production (MCF): 107** 10-acre spacing units; well location in center of each unit with 100' topographic tolerance (Order 35-63). Unitized for waterflood of Phosphoria-Tensleep formations using produced fluids (Order 21-70). EOR approved (Order 62-85)
Gage	Amsden 2	1,303	0	**Cumulative Oil Production (Bbls): 682,136** 40-acre Amsden spacing units; well to be in center of each unit with a tolerance of 150' for topographical or geological reasons (Order 120-80). Field enlargement (Order 44-81).
Golden Dome	Eagle 1 Frontier 5 Greybull 2	0 307 28 335	1,917 29,617 23,156 54,690	**Cumulative Oil Production (Bbls): 124,336** **Post-1986 Gas Production (MCF): 2,263,994** Originally 160-acre spacing for Judith River, Claggett, and Eagle (Virgelle); wells to be 660' from spacing unit boundary (Order 15-72). Single spacing unit for Greybull Formation (Order 17-82). Field enlargement and inclusion of Frontier and Greybull formations (Order 135-82

Field Name	Formation; # of Wells	Oil, Bbls	Gas, MCF	Cumulative Production And Regulation Summary
Gray Blanket	Tensleep 2	14,938	0	**Cumulative Oil Production (Bbls): 474,270** 40-acre spacing units for Tensleep Formation. Wells located no closer than 330' to spacing unit boundary with 150' tolerance upon administrative approval (Order 20-92)
Hawk Creek				**Cumulative Oil Production (Bbls): 13,277** Statewide.
Hiawatha	Tyler 2	7,885	0	**Cumulative Oil Production (Bbls): 1,768,755** **Post-1986 Gas Production (MCF): 15,132** Statewide
High Five	Tyler 5	47,340	4,388	**Cumulative Oil Production (Bbls): 3,269,223 Post-1986 Gas Production (MCF): 158,200** Spacing waived, unitized, and polymer-waterflood authorized (Order 110-80).
Howard Coulee	Tyler 1	6,841	0	**Cumulative Oil Production (Bbls): 261,022** Statewide
Ivanhoe	2nd Cat Creek 1 Morrison 2 Amsden 1 Tyler 3	625 3,200 205 18,833 22,863	0 0 0 0 0	**Cumulative Oil Production (Bbls): 4,871,881** 40-acre spacing unit for production from any one formation; well location in center of unit with 200' topographic tolerance (Order 7-60 and 13-56). Field size reduced (Orders 27-89 and 29-89)
Jack Creek				**Cumulative Oil Production (Bbls): 1,310** Statewide
Jim Coulee	Tyler 2	2,355	0	**Cumulative Oil Production (Bbls): 4,535,212** **Post-1986 Gas Production (MCF): 34,599** Unitized, no well to be drilled closer than 330' to unit boundary (Order 18-72).
Keg Coulee	Tyler 15	8,408	0	**Cumulative Oil Production (Bbls): 5,838,109** **Post-1986 Gas Production (MCF): 361** 40-acre spacing in southwest portion of field; spacing is waived in unitized portion (Orders 3-64, 4-64, 23-64). 80-acre spacing in remainder of field with variable pattern (Orders 11-60, 28-62). 40-acre spacing: W½E½ and W½ Sec. 35, T. 11 N., R. 30 E.; NW¼ Sec. 35, T. 11 N., R. 30 E; NW¼ Sec. 2, T. 10 N., R. 30 E. (Order 23-72). Topographic tolerance varies from 100' to 250' (Order 11-60, 4-64, 23-64). Buffer zone waived (Order 16-65). Field reduction (Order 2-76). Amended (Order 58-76). Three waterflood units (Orders 3-64, 28-66, 14-69). Expanded enhanced recovery unit approved effective 11/1/94 (Order 94-94)

Field Name	Formation; # of Wells	Oil, Bbls	Gas, MCF	Cumulative Production And Regulation Summary
Keg Coulee, North	Tyler 1	222		**Cumulative Oil Production (Bbls): 451,623** 40-acre Tyler Fm. spacing units with wells to be located at center of each spacing unit; 150' topographic tolerance (Order 46-64). Field reduction (Order 59-76).
Kelley	Tyler 1	2,928	0	**Cumulative Oil Production (Bbls): 1,058,333** **Post-1986 Gas Production (MCF): 3,326** 40-acre spacing units with well at center of spacing unit with a 250' topographic tolerance (Order 15-67). Waterflood using Third Cat Creek water (Orders 8-69, 51-76). Certified as an expanded enhanced recovery unit effective 4/1/95 (Order 19-95).
Lake Basin	Eagle 9 Telegraph Creek 1 Big Elk 1 Claggett, Eagle, Telegraph Creek 1 Eagle, Claggett, Virgelle 2 Eagle, Telegraph Creek 1	0 0 0 0 0 0 0 0	36,283 1,907 749 889 10,122 49,950	**Cumulative Oil Production (Bbls): 473,639** **Post-1986 Gas Production (MCF): 1,778,52979** 160-acre spacing units to base of Virgelle; wells no closer than 660' to unit boundary and 990' to field boundary; commingling with administrative approval (Order 9-74).
Lake Basin, North				**Post-1986 Gas Production (MCF): 42,154** 640-acre spacing units for all productive horizons; locations 990' from section line (Orders 6-58, 3-74). 160-acre spacing units for Claggett and Eagle/Virgelle, wells located no closer than 660' to quarter section lines within restricted sections (Order 63-76). 160-acre spacing units for Frontier gas, T. 2 N., R. 21 E., sec. 27: W½ and sec. 34: NW¼, 660' external setback (Order 63-99).
Laurel				**Cumulative Oil Production (Bbls): 1,017** **10-acre spacing units for Dakota Fm.; wells to be located in center of spacing unit with 75' topographic tolerance** **(Order 15-62)**
Little Basin				**Post-1986 Gas Production (MCF): 465,325** 640-acre Frontier spacing units; one well per section located no closer than 990' to spacing unit boundary (Order 27-86).

Field Name	Formation; # of Wells	Oil, Bbls	Gas, MCF	Cumulative Production And Regulation Summary
Little Wall Creek	Tyler 3	5,527	0	**Cumulative Oil Production (Bbls): 3,945,220** **Post-1986 Gas Production (MCF): 219,463** Little Wall Creek Tyler Sand Unit (Order 40-84). Weisner Tyler Sand Unit approved (Order 65-91)
Little Wall Creek, South	Tyler 4	13,755	0	**Cumulative Oil Production (Bbls): 1,547,806** **Post-1986 Gas Production (MCF): 110,657** South Little Wall Creek Unit waterflood (Order 85-83). Gunderson Tyler Sand Unit (Order 39-87; unit area reduced by Order 21-92). Hamilton-Gunderson Tyler Sand Unit (Order 22-92)
Lodge Grass				**Cumulative Oil Production (Bbls): 399,880** Statewide
Mackay Dome				**Cumulative Oil Production (Bbls): 118,812** Statewide.
Mason Lake	1st Cat Creek 2 Amsden 1	3,823 1,072 4,895	0 0 0	**Cumulative Oil Production (Bbls): 1,017,225** 80-acre 1st Cat Creek Sand spacing units consisting of one half of a quarter section lying in either east-west or north-south direction; well location in center of the NE and SW quarter-quarter sections of each quarter section, with 75' topographic tolerance (Order 35-78). Amend Order 35-78 for certain lots designated as spacing units (Order 66-78). Field enlargement (Order 16-79). Pilot enhanced recovery approved (Orders 37-88, 67-89 and 52-90). Mason Lake (1st Cat Creek) Unit approved (Order 80-96).
Mason Lake North				**Cumulative Oil Production (Bbls): 17,923** Statewide.
Melstone	Tyler 2	1,479	0	**Melstone Cumulative Oil Production (Bbls): 3,386,251** Statewide
Melstone, North	Tyler 4	11,705	6,207	**Cumulative Oil Production (Bbls): 786,152** **Post-1986 Gas Production (MCF): 291,511** Waterflood unit approved (Order 125-82). Polymer-augmented tertiary recovery project approved (Order 37-84). Certification as expanded enhanced recovery unit (Order 89-94).
Mosser Dome	Greybull 2 Mosser Sd 19	1,123 9,945 13,327	0 0 0	**Cumulative Oil Production (Bbls): 495,281** Spacing waived. Future development requires administrative approval (Order 27-62)
Mud Creek				640-acre spacing units; wells located no closer than 1320' to section lines (Order 9-63). Amended to allow production from two wells in Sec. 12, T. 6 N., R. 17. E. (Order 49-92).

Field Name	Formation; # of Wells	Oil, Bbls	Gas, MCF	Cumulative Production And Regulation Summary
Musselshell	Tyler 1	30	0	**Cumulative Oil Production (Bbls): 45,054** Statewide
Park City .				**Post-1986 Gas Production (MCF): 64,165** Statewide.
Pole Creek				**Cumulative Oil Production (Bbls): 169,726** Statewide
Ragged Point	Tyler 4	1,106	0	**Cumulative Oil Production (Bbls): 3,810,132** **Post-1986 Gas Production (MCF): 17,488** 40-acre spacing units; 75' topographic tolerance (Order 8-59). Spacing waived for Tyler "A" Sand Unit except no well can be closer than 660' to unit boundary, Tyler "A" waterflood (Order 35-65). Certification of expanded enhanced recovery project effective 4/1/95 (Order 18-95)
Ragged Point, Southwest	Tyler 6	5,919	0	**Cumulative Oil Production (Bbls): 683,752** Waterflood approval; drill and produce Tyler "A" Formation wells anywhere within the unit but not closer than 330' to the unit boundaries (Order 83-82)
Rapelje				**Post-1986 Gas Production (MCF): 193,405** 160-acre spacing for formations from surface to base of Telegraph Creek; wells no closer than 990' to unit boundary; commingling with administrative approval (Order 29-73)
Roscoe Dome				**Cumulative Oil Production (Bbls): 15,556** Statewide. Steam injection into Greybull and Lakota formations (Order 40-82).
Sheepherder				**Cumulative Oil Production (Bbls): 76,942** Statewide.
Sixshooter Dome	Eagle 3 Lakota 2 Big Elk, Lakota 1	0 0 0 0	5,065 43,164 3,907 52,136	**Post-1986 Gas Production (MCF): 2,673,881** 160-acre spacing units for gas production at a depth from 969' to 1500'; wells no closer than 660' to spacing unit boundary with 75' topographic tolerance (Order 18-92).
Snyder				**Cumulative Oil Production (Bbls): 477,620** **10-acre spacing units with center 5-spot permitted; 150' topographic tolerance (Order 45-62)**

Field Name	Formation; # of Wells	Oil, Bbls	Gas, MCF	Cumulative Production And Regulation Summary
Soap Creek	Tensleep 8 Amsden 1 Madison 18 Madison, Amsden 6 Tensleep, Amsden 1	2,190 900 25,384 10,900 1,326 40,700	0 0 0 0 0 0	**Cumulative Oil Production (Bbls): 3,291,058** One well per 10-acre spacing unit per producing formation; well location in center of spacing unit with 100'topographic tolerance. Delineation includes Madison, Amsden, and Tensleep formations (Order 26-60).
Soap Creek, East	Tensleep 3	5,172	0	**Cumulative Oil Production (Bbls): 263,386** Statewide
Stensvad	Tyler 8	12,973	0	**Cumulative Oil Production (Bbls): 10,438,321** 40-acre spacing units; well location in center of spacing unit with 200' tolerance (Orders 2-59 and 7-60). Wells may be drilled anywhere within waterflood unit boundary, no closer than 660' to unit boundary (Order 5-65, amended). Field enlarged (Order 22-59). Waterflood area enlarged (Order 9-67).
Tippy Buttes				**Cumulative Oil Production (Bbls): 126,246** **Post-1986 Gas Production (MCF): 2,219** Statewide. Water injection into lower Tyler Formation (Order 57-82)
Toluca	Belle Fourche 38 Greenhorn 1 Belle Fourche-Greenhorn 19	0 0 0 0	309,322 13,294 85,169 407,785	**Post-1986 Gas Production (MCF): 407,785** Delineated for production of gas from the surface through the Frontier Fm. with 160-acre spacing units, 660' setback from spacing unit boundaries (Order 28-83). Field enlargement (Order 42-02).
Wagon Box				**Cumulative Oil Production (Bbls): 32,412** Statewide.
Weed Creek	Amsden 1	3,258	0	**Weed Creek Cumulative Oil Production (Bbls): 656,784** **Post-1986 Gas Production (MCF): 9,341** Statewide.
Willow Creek, North	Tyler 3	4,396	0	**Willow Creek, North Cumulative Oil Production (Bbls): 452,057** Statewide. Pilot waterflood (Order 19-72)
Winnett Junction	Tyler 2	6,186	0	**Winnett Junction Cumulative Oil Production (Bbls): 1,161,577** 20-acre spacing units consisting of W½ and E½ of quarter-quarter section, no closer than 120' to the boundary of a spacing unit (Order 57-76). Certain lands vacated (Order 41-77). A waterflood operation commenced October 1, 1977 into Tyler Formation (Order 41-77)

Field Name	Formation; # of Wells	Oil, Bbls	Gas, MCF	Cumulative Production And Regulation Summary
Wolf Springs	Amsden 5	5,345	0	**Cumulative Oil Production (Bbls): 4,930,398** **Post-1986 Gas Production (MCF): 9,073** 80-acre Amsden spacing units consisting of N½ and S½ of each quarter section; well location in center of NW¼ and SE¼ of each quarter section with 75' topographic tolerance (Orders 4-56, 9-59). Boundary changes (Orders 92-76 and 5-90)
Wolf Springs, South	Amsden 3	1,040	0	**Cumulative Oil Production (Bbls): 927,874** 80-acre spacing units for Amsden comprised of W½ or E½ of quarter section; wells located center of NW¼ or SE¼ of quarter section with 150' topographic tolerance (Order 57-84). Field enlargement (Order 8-85). South Wolf Springs Amsden Unit (Order 23-92). Expanded enhanced recovery unit effective 6/29/94 (Order 52-94).
Woman's Pocket				**Cumulative Oil Production (Bbls): 3,526** Statewide
Production Totals for 2008	**361 producing wells**	**726,814 Bbl**	**3,055,689 MCF**	

Appendix C

Typical Drilling and Completion Sequence

Before an oil or gas well is drilled, an Application for Permit to Drill (APD) must be approved by the Montana Board of Oil and Gas Conservation Commission. If the well will be located on Federal or Indian Reservation lands, an APD must also be approved by the Bureau. Not every approved application is actually drilled. The drilling and completion sequence for a targeted reservoir generally involves:

-constructing the well pad, associated reserve pits, and the access road prior to moving the drilling equipment on to the well location;

-using rotary equipment, hardened drill bits, weighted drill pipe/collars, and drilling fluids to cool and lubricate the drill bit, which all result in easier penetration of the subsurface formations;

-inserting casing to protect the subsurface and control the flow of fluids (oil, gas, and water) from the reservoir;

-perforating the well casing at the depth of the producing formation to allow flow of fluids from the formation into the borehole;

-hydraulically fracturing and/or acidizing the formation to increase permeability and the deliverability of oil and gas to the borehole;

-inserting tubing into each well to allow for controlled flow of fluids (oil, gas, and water) from the reservoir to the surface;

-installing a wellhead at the surface to regulate and monitor fluid flow and prevent potentially dangerous blowouts;

-interim reclamation of the portions of the well pad and access road that will not be used in the production phase of the well; and

-reclaiming the entire pad and access road after the well has ceased production and is plugged and abandoned.

The cost of developing conventional deposits of oil and gas in the Rocky Mountain region is higher than the average for the onshore 48 contiguous states (Cleveland, 2003). Factors that may contribute to higher costs include:

-changes in rig availability;

-changes in development priority as industry focus on certain plays evolves with new discoveries and changes in oil and gas price;

-harsh environments (particularly cold temperatures); and

-labor market conditions.

Drilling improvements have occurred in new rotary rig types, coiled tubing, drilling fluids, and borehole condition monitoring during the drilling operation. Improvements in technology are allowing directional and horizontal drilling use in many applications. New bit types have boosted drilling productivity and efficiency. New casing designs have reduced the number of casing strings required. Environmental benefits of drilling and completion technology advances include:

-smaller ‘footprint’ (less surface disturbance);

-reduced noise and visual impact;

-less frequent maintenance and workovers of producing wells with less associated waste;

-reduced fuel use and associated emissions;

-enhanced well control for greater worker safety and protection of groundwater resources;

-less time on site with fewer associated environmental impacts;

-lower toxicity of discharges; and

-better protection of sensitive environments and habitat.

Appendix D

The following paragraphs are excerpted from the RFDS prepared for the 2008 North Dakota Resource Management Plan:

EXPLORATORY AND PRODUCTION ACTIVITY AND OPERATIONS

The following discussion brings together known information on past and present exploratory and production operations and activity for the Billings Field Office. Information is presented in the approximate sequence that occurs when project areas or fields are explored and then developed. The sequence begins when initial exploratory activity begins, and ends when projects are abandoned.

EXPLORATORY ACTIVITY AND OPERATIONS

The petroleum industry in the U.S. has historically relied on continual improvements in technology to better understand the oil and gas resource locked in the earth and to find and produce it. Some of the biggest breakthroughs have been:

- the anticlinal theory (1885) that oil and gas tend to accumulate in anticlinal structures, which allowed drillers to locate better drilling spots with improved opportunities to find oil and gas;
- rotary drilling rigs (1900s), which became the chief method of drilling deeper wells;
- seismograph (1914), which allowed one dimensional subsurface imaging;
- well logging (1924), which allowed measurement of subsurface rock and fluid properties;
- offshore drilling (1930s), which allowed drillers to access new areas and basins;
- digital computing (1960s), which allowed two dimensional imaging of data;
- directional drilling (1970s), which allowed more cost efficient management of reservoirs;
- three dimensional seismic (1980s), which allowed more accurate subsurface imaging;
- three dimensional modeling and four dimensional seismic (1990s), which allowed the prediction of fluid movement in the subsurface;
- identification of new types of reservoirs and improved exploitation methods (1990s to present) allowed development of heavy oil, tight gas, shale gas, coalbed gas, and the use of carbon dioxide in the flooding process to increase recoveries; and
- multi-discipline collaboration (2000s), which allows for better drilling decisions, higher success rates, improved risk assessment, and enhanced reservoir development.
- Exploratory activity includes:
- the study and mapping of surface and subsurface geologic features to recognize potential oil and gas traps,

- determining a geologic formations potential for containing economically producible oil and gas,
- pinpointing locations to drill exploratory wells to test all potential traps,
- drilling additional wells to establish the limits of each discovered trap,
- testing wells to determine geologic and engineering properties of geologic formation(s) encountered, and
- completing wells that appear capable of producing economic quantities of oil and gas.

Innovative drilling and completion techniques have enabled the industry to drill fewer dry holes and to recover more oil and gas reserves per well. Smaller accumulations once thought to be uneconomic can now also be produced. In some cases, improvements have also allowed down spacing (increased density development) to occur. Industry is drilling fewer dry holes and reducing the number of wells needed to fully develop each reservoir. The Energy Information Administration (2007b) has projected the increase in percentage of wells drilled successfully will be 0.2 percent per year to 2030.

From the early 1990's to present, activity has focused almost entirely on very low risk development drilling in and around known field areas, which helped to improve the overall success rate. More future exploratory drilling will be required to discover new resources in the Study Area and to determine whether its potential coalbed gas resource is economic to produce. Since the risk of failure is higher for these types of activities, the recent very high success rates could decline in the future.

Advances in technology have boosted exploration efficiency, and additional future advances will continue this trend. Significant progress that has and will continue to occur is expected in:

- computer processing capability and speed;
- remote sensing and image-processing technology;
- developments in global positioning systems;
- advances in geographical information systems;
- three-dimensional and four-dimensional time-lapse imaging technology that permits better interpretation of subsurface traps and characterization of reservoir fluid;
- improved borehole logging tools that enhance our understanding of specific basins, plays, and reservoirs; and
- advances in drilling that allow more cost-efficient tests of undepleted zones in mature fields, testing deeper zones in existing fields, and exploring new regions.

Appendix E

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