

Bridger-Teton RFDS Summary

August 2008

Oil and Gas Exploration and Development History

Oil and gas exploration and development in Sublette County dates back to the discovery of oil in the LaBarge field area in the early 1900's. A summary prepared by BLM (2006) indicates that the first production from the LaBarge field was obtained in the spring of 1924. By 1929, the Dry Piney and LaBarge field was producing about 2,000 barrels per day. Acceleration of drilling activity has coincided with periods of increased demand, such as World War Two (oil demand), the energy boom of the 1970s (oil and increasing gas demand), and the current high level of gas drilling activity that has been occurring in recent years. This recent acceleration is at least partly in response to increased knowledge of the area, improved gas prices, and improvements in techniques used to drill and complete wells. Increased drilling activity has been concentrated within the Jonah Field, which began in earnest in 1997, and the Pinedale Anticline which began in 2000.

Oil and gas fields that include some of the NFS lands in the vicinity of the lease parcels are the Soda, Riley Ridge, Lake Ridge, Fogarty Creek, and Maki Creek fields. Other fields in the vicinity of the lease parcels, but located outside the National Forest boundary, include the Mickelson Creek and Merna fields.

Only two exploratory wells have been drilled on the subject leased lands. Gulf Oil Corporation drilled a 7,851 foot test in 1961 and Davis Oil Company drilled an 11,928 foot test in 1978. Both wells were not productive and were abandoned.

A total of 73 other wells have been drilled in surrounding management areas. Three small fields have been discovered in these areas. Maki Creek has produced from the Mesaverde Group in two (presently shut-in) wells. Soda Field has produced from the Frontier Formation in four (presently shut-in) wells. The Cabin Creek Unit well (Section, 33, Township 37 North, Range 114 West) recovered oil and gas from the Madison Limestone. This well was determined to be uneconomic to produce by the operator and it was abandoned, but the Wyoming State Geologic Survey carries it as an abandoned field.

Additional wells produce carbon dioxide rich gas from the Madison Limestone at Lake Ridge and Fogarty Creek fields and are capable of producing at Riley Ridge Field. Madison production from these fields comes from a large reservoir delineated by Stilwell (1989). Pending leases WYW173043, WYW173044, WYW173278, WYW173279, and WYW173280 lie within the limits of this reservoir, although not at the best locations for near-term development.

| Field Name | Discovery Date | No. of wells | Gas MCF (cum) | Oil BBLs (cum) |
|-------------------|-----------------------|---------------------|----------------------|-----------------------|
| Mickelson Creek | 1960 | 19 | 7,790,896 | 244,513 |
| Fogarty Creek | 1979 | 22 | 3,242,767,935 | 69,542 |
| Maki Creek | 1980 | 2 | 525,005 | 13,062 |
| Riley Ridge | 1980 | 8 | 1,415,851 | 14,027 |
| Lake Ridge | 1981 | 6 | 1,386,769,421 | 6,500,063 |
| Merna | 2001 | 2 | 99,659 | 364 |
| Soda | 1982 | 4 | 382,910 | 19,443 |

The above table shows that gas is the primary production target and that existing fields have a relatively small number of wells.

Projections of Future Activity

The occurrence potential categorizes the likelihood of encountering hydrocarbon-bearing rocks at depths that can be feasibly drilled and produced. This interpretation is based on the following information: RFDs analysis prepared by BLM; geology and structure; USGS oil and gas assessment provinces and applicable Total Petroleum System (TPS) mapping/assessment units/results for each province; existing leases and units held by production; oil and gas fields; producing wells; shut-in wells; plugged and abandoned wells; and existing leases not held by production.

Areas with a high occurrence potential are characterized by the presence of proven source and reservoir quality rocks that have experienced a favorable thermal maturation history for the generation and trapping of significant hydrocarbon accumulations. Areas with moderate occurrence potential are those characterized by geophysical or geological indications of the presence of source and reservoir quality rocks which may have undergone a favorable thermal maturation history for the generation and trapping of hydrocarbon accumulations. Areas with low occurrence potential are characterized by an absence of one or more key characteristics (source rocks, reservoir rocks, thermal maturation, and/or trap presence). Areas with no known hydrocarbon occurrence potential are those areas without source rocks, reservoir rocks, favorable thermal maturation history, or traps essentially excluding the occurrence of hydrocarbons in the area.

A high level of exploration and production of natural gas from continuous (basin-centered) gas accumulations would continue during the 10 to 15-year planning horizon in the Southwest Wyoming Province (SWWP). Energy companies will continue to search diligently for other Jonah-type fields in the central and northern portions of the project area. It is likely that additional new target areas (new lease areas) on NFS lands will be explored rather than ignored during the 10 to 15 year planning horizon. The northern lease parcels (Sheet 1 of 3) represent an area that may have favorable targets for continuous gas accumulations. Where existing access is good, and few lease stipulations and notices have been applied to lease parcels within the SWWP Mesaverde–Lance–Fort Union Continuous Gas Analysis Unit (AU), a good opportunity for an exploratory

program, referred to in this RFD as the Beaver-Horse Exploratory Gas Wells (1 to 5 exploratory wells), would exist.

The Mesaverde–Lance–Fort Union Continuous Gas AU is producing regionally in the Jonah and Pinedale Anticline fields. A proposal to test a portion of this AU just north of the northernmost block of lease parcels (those parcels shown on Sheet 1 of 3) is currently being evaluated by the Big Piney Ranger District of the BTNF. That proposal, by Plains Exploration and Production Company Inc. (PXP) would involve exploratory drilling of 1 to 3 wells from one wellpad located in T.36N. R.113W., Section 8. The Merna field (T.36N. R.112W. Section 28) is located less than 10 miles east of the PXP Eagle Prospect.

Within the planning horizon of 10 to 15 years, it is reasonably foreseeable that this system (Mesaverde–Lance–Fort Union) will be tested by an exploratory program located somewhere on the northernmost block of lease parcels (those parcels shown on Sheet 1 of 3), given the high interest in the Jonah and Pinedale Anticline fields. An exploratory program for continuous gas accumulations could be based on 1 to 5 bottomhole locations drilled initially from a single multi-well pad. One well pad 8 acres in size would be adequate for drilling 1 vertical and 4 directional boreholes (bottomhole locations), each about 10,000 to 14,000 feet deep. Anticipated surface disturbance associated with this exploratory program could be comparable to the PXP exploratory program, affecting 11-12 acres over the short term (pad and access) and 6 acres over the long term, if the exploratory wells are productive. If planned exploratory wells are successful, development likely would proceed on 40 to 80-acre spacing for bottomhole locations drilled from multi-well pads.

Most of the subject 44,720 acres lie within a reasonable foreseeable development analysis area prepared by Stilwell and Crockett (2006) for the Pinedale Field Office Planning Area. Their analysis was used to project the number of wells that could be drilled on the subject leased land in the next 10-15 years (assuming those land would not be restrained by management-imposed restrictions). Approximately 528 leased acres lie within the Kemmerer Field Office Planning Area and the same assumptions and projections were made for those lands. Analysis indicated that 27 wells could be drilled on the subject leased lands in the next 20 years. Some small number of these wells could be coalbed gas wells. The projection of 27 wells should be considered as the most likely number of wells that could be drilled.

Coalbed gas wells in this area would likely be undistinguishable from wells producing from sandstone or shale formation. Most of the coal zones are within the Mesaverde Group or the Bacon Ridge Formation, which are known to be overpressured. Being overpressured, these zones would not require de-watering to create a pressure gradient to release the gas as is the case in the Powder River Basin. Coalbed gas in the Powder River is produced from shallow, low pressure zones. Large volumes of produced water would not be anticipated for any wells within the project area.

There is some geologic uncertainty as to whether any oil or gas exists under the leased tracts. Rose (2001) reported that new field wildcats during the 1980's in the U.S. were 13-18% successful. These types of wells have relatively low probability of success due to the high risk associated with finding an economically productive reservoir. Using probability theory presented by Rhoads (2003), a calculation of probability of success of obtaining at least one successful well after 27 attempts would be between 97.7 and 99.5 percent, using success rates reported by Rose (2001). It appears very likely that if 27 new field wildcats are drilled in the subject leased area, then at least one new field discovery may be made. It is very likely that a new discovery would be in the small field size (less than one million barrels of oil equivalent or less than six billion cubic feet of gas) with six or fewer producing wells since Root and Attanasi (1993) estimated the 89% of the ultimate number of discovered fields in the lower 48 states would be in the small field category. As stated earlier, the few fields discovered in the immediate area are considered to be small in size and help confirm that any new discovery will likely also be small in size.

Realistic upper and lower ranges of the number of potential future wells drilled can also be projected from the historical record and exploration proposals made for the leased area. There is a very high probability (probably greater than 19 in 20) that at least two new wells could be drilled and a very low probability (probably much less than 1 in 20) that at least 200 new wells could be drilled in the next 20 years on the subject leased lands.

It is possible that additional new target areas (new lease areas) on NFS lands will be drilled rather than ignored during the 10 to 15 year planning horizon. The central and southern lease parcels (Sheets 2 and 3) represent areas that may have favorable targets for infill and well replacement drilling, and drilling to greater depths near existing fields. However, the central and southern lease parcels adjoin many existing leases and units already held by production.

Moderate development potential is anticipated on the La Barge Platform. Drilling densities would be anticipated to vary from relatively dispersed, with up to 4 bottomhole locations per square mile, to local areas with more intense drilling activity. On average, given the acreage included in the parcels, most parcels would likely have 0 to 2 wells drilled over the 10 to 15-year planning horizon. Parcels WYW173278, WYW173279, and WYW173280 would each be likely to have 2 wells drilled over the 10 to 15-year planning horizon.

Summary of Potential Surface Disturbance:

Drilling and well pads: With the estimate that 27 wells could be drilled in the next 10-15 years, up to 10 of those wells could be exploratory wells and 17-25 would be development wells should a field(s) be discovered. If a discovery is made with one of the initial exploratory wells, then more of the 27 projected wells (i.e., 25) would be associated with development.

A limit of 10 exploratory wells is deemed reasonable because of the limited acreage available to explore. Industry would lose interest in this area if no production is found after the 10 exploratory wells. Should additional acreage be leased, or technology and new information indicate deeper economic reserves are possible; a few additional wells may be drilled to test those zones.

The 10 exploratory wells would be single well pads and if nonproductive, would be reclaimed upon completion of the drilling process. The pads would be approximately 400 ft. by 350 ft. or 3.2 acres in size (including cut and fill slopes).

Should one of the exploratory wells discover a new field, the well pad would be expanded to accommodate additional wells or a second larger pad (approximately 8 acres in size) constructed and 5 development wells drilled from that location; 1 straight hole and 4 directional. Similar pads and drilling processes would continue until the outer limits of the field are defined. *Should reservoir characteristics require closer well spacing, additional wells could be directionally drilled from those pads.*

Pads would temporarily impact 32 acres (10 exploratory wells x 3.2 acres) and approximately 24 acres (3 multi-well pads x 8 acres), for a total disturbance of 56 acres.

Roads: Access roads would typically be single lane roads (14 ft. driving surface) with turnouts as needed. It is estimated that approximately 0.7 miles of road would be needed to access each of the 27 well pads for a total of 18.9 miles. With a 40 foot construction width, approximately 3.4 acres would be impacted per location. For the 27 wells that would result in impacts to 91.8 acres. In the north block of parcels, due to the density of existing roads most of the impact would involve reconstruction rather than new construction.

Pipelines: Pipelines would generally be laid within the road prism and therefore would not add to the surface disturbance acreage.

Also, non-productive wells and associated access roads would be reclaimed within one year of completing the well, and vegetation re-established within a couple growing seasons. As such the total acreages identified above would be cumulative for the 10-15 year period and not anticipated to occur at any give point in time. If wells are productive the pad is reduced to the area needed for production which typically decreases the area by half or more. Also, all but the 14 ft. driving surface of the access road would be reclaimed.

Principal Assumptions for Post-Leasing Activities on the BTNF

Lack of pipeline capacity may make any marginally productive discoveries uneconomic to develop and may temporarily constrain drilling activity over several years for better discoveries, until additional gathering and sales pipelines come online.

Drilling and production activity will be related to the future price for natural gas. Supporting factors include an increase of about 50 percent in the U.S. demand for natural gas by 2020, and future anticipated prices for natural gas through 2020 that make it possible for unconventional resource plays to achieve rates of return on investments adequate to support anticipated levels of activity.

It is unlikely that projected future crude oil prices will significantly increase drilling and production activity on the affected lease parcels.

Geophysical (seismic) exploration in western Wyoming will continue to be an important exploration tool to delineate or identify potential targets within the Thrust Belt province. Geophysical operations in the vicinity of the affected lease parcels will most likely be conducted using heli-portable techniques which have very minimal and short term effects.

Drilling activities during the 10-15 year planning period are most likely to be primarily for continuous type gas reservoirs and secondary for conventional reservoirs.

An exploratory program for continuous gas accumulations could be based on 1 to 5 bottomhole locations drilled initially from a single wellpad. If initial exploratory wells are successful, development likely would proceed on 40 to 80-acre spacing for bottomhole locations from multi-well pads.

Close well spacing and hydraulic fracturing is necessary to produce gas accumulations in fields with producing zones consisting of numerous, stacked and discontinuous sandstones.

For continuous type reservoirs, one well pad 8 acres in size would be adequate for drilling up to 16 directional boreholes (bottomhole locations), each about 10,000 to 14,000 feet deep. Eight directional wells could reach all 80-acre drilling locations in a section, while 16 directional wells could reach all 40-acre drilling locations. After all bottomhole locations are drilled from a well pad, the footprint of the well pad would be reduced to 2 acres through interim reclamation activities. An estimated 0.7 mile corridor within each section would contain the well pad access road system and gathering lines and would disturb a 40-foot width.

Coalbed natural gas development potential for the subject leases is 2.3% moderate, 70% low, 23.7% very low, and 4% no potential.