

REASONABLY FORESEEABLE DEVELOPMENT SCENARIO FOR OIL AND GAS



Wolverine Oil Covenant Field

**Richfield Field Office
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Summary

Recent exploration and drilling results in the western portion of the Richfield planning area have precipitated much interest in leasing and exploration. Prior to this the area had received little attention as a potential oil and gas area during the past 15 years. Based on geology, leasing activity, proposed drilling and a comparison with the history of development in the Northern Utah-Wyoming Overthrust Belt in the 1970s we are projecting that 360 wells will be drilled in this area during the next 15 years. The ownership pattern in this belt is a mixture of BLM lands, State of Utah lands and privately owned lands. Each well pad will disturb about 4 acres and will require about 2 miles of new roads. Early development activity indicates that multiple wells will be drilled from many pads with the overall effect of reducing total impacts.

The southern half of the planning area will receive much less attention and 45 wells are projected again with 4 acre pads and 2 miles of road. The remainder of the planning area is the Wasatch Plateau which is largely National Forest. Forty nine wells are expected in this area and many of these will be coalbed methane tests. Each pad here will disturb about 2 acres and require 5 miles of road/well.

The other major source of surface disturbance will be geophysical exploration. Most of this is projected to occur in western part of the planning area and will disturb approximately 4500 acres, much of which will likely be on privately owned lands. In the Wasatch Plateau area helicopters will be used in some areas and disturbance is expected to be 360 acres. Fewer geophysical surveys are anticipated for the remainder of the planning area and disturbance is estimated to be 240 acres.

It is assumed that any future pipelines, power lines, etc. would follow roads where possible and that continuing reclamation of surface disturbance will reduce net impacts. Future field discoveries, if any, will result in the construction of production facilities and some additional impacts outside the well pads.

Total surface impacts are estimated to be about 8180 acres (5100 acres from geophysical + 3080 acres from drilling).

Introduction

The following Reasonably Foreseeable Development Scenario (RFD) projects the level of oil and gas activity that can reasonably be expected during the next 15 years in the planning area. All lands (Federal, State of Utah and Private) are included in the projection following guidance in BLM Handbook H-1624-1 and Instruction Memorandum No. 2004-089. It will be assumed that all potentially productive areas are open under standard lease terms and conditions except those areas designated as closed to leasing by law, regulation or executive order.

Worldwide demand for oil and gas continues to grow and all indications are that growth will continue. Against this background geology, past and present activity, economics and other factors will determine the level of activity in the planning area.

Description of Geology

Geology is the ultimate controlling factor in determining future hydrocarbon exploration and development and the discussion will consider the geological differences within the RFO as they relate to oil and gas potential. The basic units considered will be the individual oil and gas “play” (Gautier, *et. al.*, 1996) and “assessment unit” (Schenk, *et. al.*, 2003) as these terms are used by the United States Geological Survey (USGS) in their national assessments of oil and gas resources. The Mineral Potential Report for the Richfield RMP discusses the geology of the planning area and gives descriptions of most of the plays which are shown in figure 1 of this report.

The geologically oldest play in the planning area is the Late Proterozoic and Cambrian Play (USGS-2403) which was described in the Northern Arizona Province but includes a large portion of southern and central Utah including the southern part of the planning area. The play is based on the recognition of carbonaceous shale in the Upper Proterozoic Chuar Group in the Grand Canyon and the projection of these units in the subsurface of northern Arizona and southern and central Utah (Rauzi, 1990). Given this potential source rock hydrocarbons were possible in uppermost Proterozoic and lower Cambrian reservoirs. The play received a great deal of attention in the 1990s and several test wells were drilled in southern Utah. Some of the wells encountered carbon dioxide gas but no hydrocarbons were reported and interest in the play waned.

Four classic Paradox Basin plays underlie the extreme eastern corner of the planning area, the area generally east of Range 12 East in easternmost Wayne and Garfield Counties. The plays are identified as Buried Fault Blocks (USGS-2101), Porous Carbonate Buildup (USGS-2102), Fractured Interbed (USGS-2103) and Salt Anticline Flank (USGS-2105) (Huffman, 1996). Play 2101 is exemplified by the prolific Lisbon Field in northern San Juan County where oil and gas are produced from Devonian and Mississippian age carbonate rocks and sandstones in a faulted anticline (Smouse, 1993). Play 2102 is primarily an oil play characterized by hydrocarbon accumulations in porous algal mounds and related rocks in the Paradox Formation of the Hermosa Group (Pennsylvanian age). Traps are largely stratigraphic in nature involving porosity and permeability differences in carbonate and evaporitic rocks and organic-rich dolomitic shales. Structures of Pennsylvanian age may have influenced the locations of the algal buildups. The Giant Aneth Field in San Juan County is the largest field in this play but many other smaller isolated buildups have produced (Huffman, 1996).

Play 2103 is a continuous oil and gas play with organic rich dolomitic shales serving as both source and reservoir rocks. Fracturing of the otherwise tight rocks is necessary if it is to be productive. Dolomitic shales are interbedded with salt in a cyclical sequence where the salt provides a seal for the fractured reservoirs (Huffman, 1996). This play is productive in southwestern Grand County where current development involves horizontal wells designed to intersect vertical fractures in areas where structures have enhanced fracturing. Play 2105 involves Pennsylvanian and Permian age carbonate and sandstone reservoirs along the flanks of northwest-trending salt anticlines. Production to date has been gas mostly from Andy's Mesa Field in Colorado but the play is lightly explored (Huffman, 1996).

The Permo-Triassic Unconformity Play (USGS-2106) was included in the 1995 USGS Assessment of greater Paradox Basin resources even though it is outside the Paradox Basin proper. It includes a large part of the planning area as shown in figure 1. Known occurrences and shows are in upper Permian and lower Triassic carbonate and sandstone formations. Upper Valley Oil Field south of the planning area produces from this play and oil and gas shows have been reported over a large area in southern and central Utah. The trapping mechanism at Upper Valley is anticlinal but the oil is offset from the crest by a strong hydrodynamic drive. Huffman (1996) described the play as lightly explored and emphasizes unanswered question about source rock and timing.

Two hypothetical Eastern Great Basin Province plays include western Sevier and Sanpete Counties. These are the Late Paleozoic Play (USGS-1902) and the Sevier Frontal Zone Play (USGS-1907). Both of these plays were nonproductive and hypothetical when first described (Peterson and Grow, 1996) but recent drilling has since confirmed the Sevier Frontal Zone play. Play 1902 is based on the possibility of early-formed traps in middle and upper Paleozoic carbonates and sandstones. Potential source rocks include organic-rich marine shales in Mississippian, Pennsylvanian and Permian age formations which may have favorable maturity levels in some areas of the play. A variety of structural and stratigraphic traps may be present but the play remains hypothetical at this time.

Play 1907 was also hypothetical and based in large part on similarities in lithology and structural style between this area and productive segments of the Overthrust Belt in northeastern Utah and southwestern Wyoming. Potential traps exist in structures formed along and near the leading edge of Sevier thrust plates and favorable reservoir rock are present in several formations. Recent drilling has confirmed the presence of oil at one location along this zone and additional exploration is in progress.

The Cretaceous Sandstone Play (2107) was also included in the Paradox Basin Assessment (Huffman, 1996) but is outside the geologic boundaries of the basin. The play specifically relates to gas occurrences in sandstone reservoirs in the Wasatch Plateau. Currently interest is not so much in the sandstone reservoirs but in coal beds within the sandstones (coalbed methane). The most productive coals have been in the Ferron Sandstone Member of the Mancos Shale in Carbon and Emery Counties. Similar coals in the Emery Sandstone in the Wasatch Plateau are prospective targets. Both of these units extend into the planning area in the Wasatch Plateau area. The coalbed

methane resource was evaluated in more detail in the 2003 USGS Assessment although the area of interest coincides with that of Play 2107 as shown in figure 1.

The USGS completed a new assessment of oil and gas resources in the Uinta-Piceance Province in 2003 and included the Wasatch Plateau and Ferron Trend in the analysis. Parts of both of these regions extend into the planning area. The Uinta Basin Blackhawk Formation Coalbed Gas Assessment Unit (USGS-AU 50200281) evaluates coalbed methane (CBM) resources in the Blackhawk and Emery Sandstone coals in the Book Cliffs and Wasatch Plateau. CBM production from Blackhawk coals has been established in the Castlegate Field in northern Carbon County but production has been hampered by problems with dewatering the coal. Coalbeds in the Emery Sandstone are present in the Wasatch Plateau in Carbon, Sanpete and Sevier Counties and may have favorable maturity levels in some areas (Johnson and Roberts, 2003).

Five assessment units (USGS-AU 50200161, AU 50200183, AU 50200184, AU 50200185 and AU 50200101) of the Ferron/Wasatch Plateau Total Petroleum System are partially or wholly in the northeastern part of the planning area. More than 30 wells have been drilled in these assessment units with only one listed as productive, no volumes are listed however (Henry and Finn, 2003, p. 26). All of these are based on the known occurrence of coal beds in the Ferron Sandstone Member of the Mancos Shale. All of these gas assessments units are included within the area covered by the Cretaceous Sandstone Play (2107) in figure 1.

Past and Present Oil and Gas Activity

Geophysical Exploration

Field Office records indicate that approximately 90 authorizations for geophysical surveys were issued during the time period 1972-present in the western parts of the planning area (the old Sevier River Resource Area). Sixty five of these were issued between 1976 and 1982 with only four after 1988. The surveys resulting from the permits were spread over most of the western part of the planning area.

Fewer surveys, of unknown dates, have been conducted in the eastern part of the planning area (eastern Wayne and Garfield Counties) with a concentration in and around T. 30 S., R. 12 E. on the line separating the two counties. Several nonproductive wells have been drilled in this same area.

Beginning in 2004, there has been an increase in interest in acquiring geophysical data in the vicinity of Sevier Valley related to the recent discovery of oil. One large project (115 miles) was completed in 2004, and additional proposals by multiple companies are anticipated in 2005 and subsequent years.

Federal Oil and Gas Leasing

Significant portions of Sanpete and Sevier Counties are currently under Federal lease (Fig. 1). Leases are clustered in the western and eastern parts of the two counties with most of the eastern leases being located in the Manti-La Sal National Forest and are related to the Sevier Frontal Play and the Cretaceous Sandstone and CBM plays, respectively. Very few leases are in the Fishlake National Forest in the southern part of the Wasatch Plateau or elsewhere in this National Forest. Another block of leases covers the eastern part of the planning area in eastern Wayne and Garfield Counties. This latter group is combined hydrocarbon lease conversions in the Tar Sand Triangle Special Tar Sand Area (STSA).

The largest Federal lease sale, involving lands in the Richfield Field Office, was in June, 2004. Eighty one parcels encompassing 146,365 acres in the planning area were offered for lease at the June 25, 2004 BLM Competitive Oil and Gas Lease Sale. Several of the tracts in the western part of the area received bonus bids of more than \$100/acre with a maximum bid of \$360/acre (Fig. 2) indicating strong industry interest in this area. The lease tracts extend northward from southwestern Sevier County through western Sanpete County. This area of interest coincides with the Sevier Frontal Zone Play (USGS-1907) described above. Another block of pending leases in northeastern Wayne County resulted from the November 2003 and June 2004 lease sale but these were obtained for the minimum bonus bid (\$2.00/acre) or noncompetitively the day after the sale.

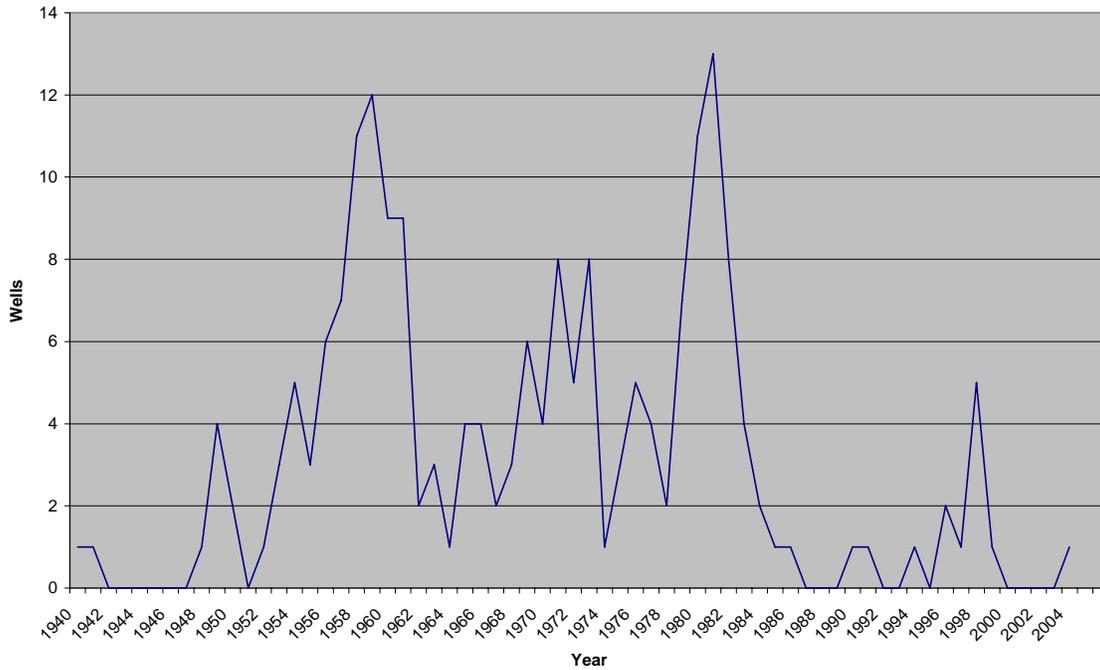
Oil and Gas Units

Wolverine Gas and Oil established the Wolverine Unit in June, 2003. The Unit Area includes 65,980 acres of Federal, State and Private lands in Sevier and Sanpete Counties (Fig. 2). The first unit obligation well was completed in 2004 and additional wells are currently permitted. No other exploration units existed in the planning area in February, 2005.

Historical Drilling and Production

Altogether, some 220 exploration wells have been drilled in the planning area (IHS Energy Well Data, 2004). Thirteen of these were drilled during the 1990-2004 period yielding an average of 0.9 new wells/year. Drilling activity peaked in the late 1950s (12 wells/year) and again in the early 1980s (13 wells/year) and if the period 1940- 2004 is considered the average number of wells drilled each year is slightly over 3 (Figure 3).

Figure 3. Wells Drilled/Year(1940-2004)



Utah Division of Oil, Gas and Mining production data (February, 2004) lists only 405 BO and 3,027,708 MCFG for Sanpete County with 3,027,183 MCFG being from the abandoned Joes Valley Field. The source of the remaining 525 MCFG and 405 BO is not given. No other historical production is listed for the planning area and Joe's Valley is the only identified field.

Oil production in the Covenant Field, associated with the Wolverine Unit, began in 2004. Production quantities are not available at this time.

Infrastructure

The Kern River gas pipeline parallels the western boundary of the planning area at a distance of 2 to 5 miles. This pipeline was built in 1991 and expanded in 2003 to transport natural gas from southwestern Wyoming and Utah to markets in southern Nevada and California. A Questar pipeline follows Highway 89 through the planning area (Fig. 4). No oil pipelines are within this part of the state and if oil is produced it would probable be trucked to Salt Lake City as has been done for 40 years with oil produced in the Upper Valley Field.

Oil and Gas Occurrence Potential

The Mineral Potential Report for the Richfield planning area describes oil and gas occurrence potential and includes maps depicting occurrence potential ratings.

Potential for Oil and Gas Activity

In the following discussion oil and gas activity will be used rather than development to avoid possible confusion between “exploration” and “development” in the strict sense. There is only one known field in the planning area at this time and many of the future wells will be exploratory in nature. The purpose of the RFD is to arrive at a reasonable estimate of surface impacts resulting from all future oil and gas activity whether it results from exploration or development activity. Future activity levels will be determined largely by the outcome of continuing testing of the Sevier Frontal Zone Play (1907) and the gas resources in the Wasatch/Ferron and Mesaverde Blackhawk assessment units, essentially the area covered by Play 2107 in figure 1. Energy demand will likely only increase in the future and if additional economically recoverable resources can be identified in The Sevier Frontal Zone Play and the area covered by Play 2107 significant activity may occur. Other plays would seem to be less prospective but will probably continue to be tested periodically. Activity levels will be projected by play, or overlapping groups of plays and then related to geographic subdivisions in the planning area.

The northwestern corner of the Paradox Basin underlies the extreme eastern portion of Garfield and Wayne counties and includes four partially overlapping plays: 2101 (Buried Fault Blocks), 2102 (Porous Carbonate Buildup), 2103 (Fractured Interbed) and 2105 Salt Anticline Flank). These plays have been tested by several wells and it is unlikely that significant drilling will occur here in the next 15 years although a few tests can be expected. Huffman (1996) gave the following assessment of plays 2101, 2102, 2103 and 2105 for the Paradox Basin as a whole: low to moderate future potential for small to medium sized fields with minimal oil columns (2101), small fields in the 1-3 mmbo range (2102), greatest potential in the Cane Creek, Chimney Rock, Gothic and Hovenweep Shales due to organic content and thickness (2103) and low potential for oil; fair to good for gas (2105). Several horizontal wells have produced from play 2103 in the Kane Springs Unit Area in Grand County southeast of the planning area but the wells are expensive and production rates declined fairly rapidly.

Plays 2106 (Permo-Triassic Unconformity) and 2403 (Upper Proterozoic Cambrian) underlie large areas in the southern and central parts of the planning area. The northern and western parts of these plays have tested carbon dioxide gas and the Paleozoic age rocks of this entire region appear to have been flushed by carbon dioxide generated by igneous activity to the north (Utah Geological Survey, 2004). Hydrocarbons may still be present in these reservoirs in the eastern and southern parts of the planning area. At the Upper Valley Oil Field (Play 2106), near Escalante, a strong hydrodynamic drive has offset the oil onto the flank of an anticlinal structure and other anticlinal flanks will

probably be tested. Huffman (1996) described Play 2106 as lightly explored and projects a low probability of any significant exploration effort until source rock and timing questions are answered.

Two hypothetical Eastern Great Basin Plays (1902 and 1907) cover western Sevier and Sanpete Counties. Play 1907 is characterized by structures along the leading edge of Sevier age faults analogous to those productive in the Wyoming Thrust Belt to the north (Peterson and Grow, 1996). Several test wells were drilled in this play in the 1970s but it had received little attention in recent years until Wolverine Gas and Oil established the Wolverine Unit in 2003. They have completed two wells with oil production reported from the Navajo Sandstone (The Rocky Mountain Oil Journal, vol. 84, No.27, July, 2004; Moulton and Pinnell, 2005) and are currently drilling additional wells while acquiring additional 2-D seismic data. Parcels within and near this play received large bonus bids at the June, 2004 BLM lease sale indicating renewed industry interest. Exploration wells will probably be located at different locations along the north-trending play and, if successful, followed by development wells. Multiple wells are projected from many drill pads which will minimize surface disturbance.

Much of the land in this play is privately owned but a block of BLM land in and around Ts. 17 & 18 S., R. 1E. is unleased and would attract a great deal of industry interest if offered for competitive bidding. Other larger blocks of BLM lands appear to be under lease and the lands mentioned above appear to be the only BLM lands where a lack of leases would be an impediment to exploration and development.

Continuing evaluation of coals and their including sandstones for gas resources can be expected in eastern Sanpete and Sevier Counties. The Uinta Basin Blackhawk Coalbed Gas Assessment Unit (AU50200281) covers parts of three field offices with approximately 45 percent of the assessment unit being in the planning area. The USGS's estimated mean value for total technically recoverable CBM in the unit is 499 bcf in the Blackhawk and Emery coals. If it is assumed that the resource is more or less evenly distributed throughout the assessment unit, however questionable this assumption may be, the planning area could contain 225 bcf of this CBM. Tabet and Quick (2003, p.10) estimated that the Emery coals under the Wasatch Plateau may contain an in-place gas resource of 0.8 to 3.2 tcf. It appears that roughly 60 percent of the area included in their estimate lies in the planning area or 0.5-1.9 tcf of CBM. How much recoverable gas is present remains to be determined but certainly there will be continuing interest in the CBM resource in this part of the planning area. These potential resources are on the Wasatch Plateau portion of the field office within the Manti-LaSal and Fishlake National Forests and existing leases cover significant portions of the Manti-La Sal N. F. in eastern Sanpete County. Leasing is not allowed under the current Fishlake National Forest Plan unless an environmental analysis is completed for specific proposals for leasing. Until a new Forest Plan is developed the absence of leasing is an impediment to exploration and development on this National Forest.

Several assessment units of the Ferron/Wasatch Plateau Total Petroleum System are partially or completely in the planning area in eastern Sanpete and Sevier Counties.

These include: Deep Coal and Sandstone Gas (AU 50200161), Southern Coal Fairway (AU 50200183), Joes Valley and Musinia Grabens (AU 50200184) and Southern Coal Outcrop (AU 50200185). The “EPCA” Report (U. S. Departments of the Interior, Agriculture, and Energy, 2003, p. 2-14) assigns undiscovered technically recoverable resources of 223 bcfg to these assessment units (AU 50200184 was not assessed by the USGS). Prorating these numbers according to area gives 173 bcfg in the planning area. Again most of this resource lies under the Manti-LaSal and Fishlake National Forests but a narrow strip of BLM land in extreme eastern Sevier County could contain some gas.

The gas content of the Ferron coals appears to decrease southward from the Drunkards Wash Field in Carbon County (Lamarre, 2001, Utah Geological Survey, 2004) and Nuccio and Roberts (2003, p. 32) show vitrinite reflectance values of less than 0.60 at the base of the Mancos Shale in much of the eastern and southern parts of the Wasatch Plateau. Higher values are indicated for parts of the northwestern Plateau in Sanpete County. These data suggest that the potential for CBM occurrence in the Fishlake National Forest is less than in the Manti-LaSal.

In addition to the coals, gas in conventional sandstone reservoirs in the same stratigraphic sequence may be tested. This area of moderate activity potential is generally the area of Play 2107 in figure 1.

Coal beds are known to occur in rocks of Cretaceous age in the Henry Mountains Basin in northern Garfield and southern Wayne Counties in the eastern part of the planning area. The presence of these coals raises the possibility of CBM activity in the basin. Coal occurs in three formations, in ascending order, the Dakota Sandstone, the Ferron Sandstone and the Muley Canyon Sandstone. The thickest and most continuous coals are in the Muley Canyon Sandstone with the other two zones containing thinner and less continuous beds (Law, 1980, p. 326). No information is available on the gas content of the coal and the USGS has not produced an assessment of the potential resource. In many areas the Muley Canyon coal is at or near the surface often exposed on the tops and flanks of mesas. The coal-bearing rocks are deeper in the southwestern part of the basin which may provide some potential for CBM retention. No oil and gas leases currently exist in the Henry Mountains Basin.

The greatest potential for oil and gas activity appears to be in Sevier and Sanpete Counties within the Sevier Frontal Zone Play (USGS 1907) and in the Wasatch Plateau area of these same two counties (gas in Cretaceous coals and sandstones). This potential is rated as high in the Sevier Frontal Zone Play and moderate in the northern part of the Wasatch Plateau decreasing toward the southwest. Less activity is predicted in the remaining parts of the planning area but exploration wells will probably continue to be drilled at near the historical rate (0.9 to 3.12/year) if oil and gas prices remain at present levels or increase as generally expected (Fig. 5).

RFD Baseline Scenario Assumptions and Discussion

In developing the baseline scenario it was assumed that all potentially productive areas are open under standard lease terms and conditions except those areas designated as closed to leasing by law, regulations or executive order. The largest block of excluded lands would be the WSAs but most of these are in areas where the potential for activity is low.

Long term well completion rates (1940-2004) have averaged slightly more than 3 wells/year. When only the past 15 years (1990-2004) are considered the rate drops to slightly less than 1 well/year (IHS Well Data, 2004). Recent interest in parts of the planning area indicates that activity during the next 15 years will be considerably higher than for either of these intervals.

For purposes of estimating the number of wells to be drilled during the next 15 years, the planning area is divided into four geographic areas defined by USGS plays and assessment units. These are: (1) the eastern portion of Wayne and Garfield Counties (generally east of R. 12 E.) which is underlain by true Paradox Basin Plays (2101, 2102, 2103 and 2105; Fig. 1), (2) The southern part of the field office as defined by the Permo-Triassic Unconformity Play (2106) on in figure 1, (3) The Wasatch Plateau as defined by the Cretaceous Sandstone Play (2107 on figure 1) but also includes CBM in the Ferron, Emery, and Blackhawk coals, and (4) the area from the eastern boundary of the Sevier Frontal Zone Play (1907) to the western boundary of the field office. These areas are shown in Figure 5.

Potential for activity in Areas 1 and 2 (entire southern part of the field office) is considered to be low as discussed above. Some exploration is expected to continue at near historic rates here considered to be 3 wells/year. This would produce 45 wells during the projection period (15 years).

Activity levels in Area 3 are expected to be higher because of the existence of coal in the Ferron, Emery and Blackhawk formations as well as conventional sandstone reservoirs. The Utah Geological Survey (2004, p.38) projects 4 CBM wells for the Fishlake National Forest during the next 15 years and this number will be used here for the southern part of the Wasatch Plateau. Potential for drilling activity on the northern part of the plateau (Manti-La Sal N. F.) is considered to be higher as discussed above. In the northern part of the plateau, 45 wells (3/year) are projected, which results in a total of 49 wells in Area 3 during the next 15 years.

The Sevier Frontal Zone Play (1907) and adjacent areas in western Sevier and Sanpete Counties are expected to be the focus of activity during the life of the plan. At the present time two wells have been completed in the Covenant Field of the Wolverine Unit. Seven additional, co-located wells are currently permitted. Moulton and Pinnell (2005, p. 42. anticipate six or more additional wells along the play by mid-2005. This would result in a total of at least 13 wells for the first half of 2005.

Play 1907 is geologically similar to the Utah-Wyoming Overthrust Belt which was the site of major exploration and development in the 1970s but includes a larger area than the productive area around the Pineview Field (Moulton and Pinnell, 2005). This central Utah thrust belt overlaps the hypothetical Late Paleozoic Play (1902) and, on Figure 5, the thrust play (1907) is extended to the western boundaries of Sevier and Sanpete Counties. Moulton and Pinnell (2005) seem to concur by showing a lease area, related to this thrust play, by extending that boundary west of the Sevier and Sanpete County lines and leases in this area commanded high bonus bids in the June, 2004 BLM lease sale. If the analogy holds true we can expect exploration activity along the length of the play followed by field development around discoveries. Moulton and Pinnell (2005, p. 42) reported that, during the 5 years after discovery of the Pineview Field in northern Utah in 1975, 175 wildcat wells were drilled leading to the discovery of 11 new fields. This averages 16 wildcats drilled for each field discovered and possibly gives some insight into what may occur in western Sevier and Sanpete Counties.

Additional data on the Utah Wyoming Overthrust Belt indicates that between 1976 and 1997 a total of 485 wells were drilled (Vrona, personal communication, 2005). One hundred thirty one (27%) of these wells were completed as dry holes. This equates to a rate of 24 wells drilled/year and, if this rate is projected for area 4, a total of 360 wells during the next 15 years is projected.

These estimates for each area are summarized below.

Area	Number of Wells
Combined Areas 1* and 2*	45
Area 3^	49
Area 4”	360
Total	454

* Plays 2101, 2102, 2103, 2104, 2105, 2106 & 2403.

^ Play 2107.

“ Plays 1907 and 1902.

Most of the 45 wells in Areas 1 and 2 will probably be on BLM lands. The northern part of Area 3 is included in the Manti-La Sal National Forest and the southern part is in the Fishlake National Forest; therefore, all of the 49 projected wells are likely to be on National Forest lands. Area 4 (Play 1907) is a mixture of BLM, State and private lands; however, State land acreage is much less than BLM and private holdings which are approximately equal in proportions and the 360 wells are expected to be divided between

Federal and private lands. Overall, 10 percent of the wells are projected for National Forest lands, 45 percent for BLM lands, 5 percent for State lands and 40 percent for private lands.

This projection should not be considered a ceiling for permitting additional wells. Any upper limit on drilling should be based on total surface disturbance and consider on-going reclamation, multiple wells from a single pad and other factors.

Surface Disturbance Due to Oil and Gas Activity on all Lands

Geophysical Surveys

Future surface disturbance will result largely from geophysical surveys and drilling (with associated access). Utah Geological Survey (2004) projected approximately 625 line miles of geophysical surveys would be required in the 1250 square miles of prospective lands in the Fishlake National Forest. Area 3 is approximately this size and using the above ratio of line miles to square miles results in a number of approximately 600 line miles for the planning area portion of the Wasatch Plateau. Continuing to follow the Fishlake estimates about 50 percent of the surveys would be buggy mounted and 50 percent would be done by helicopter resulting in approximately 300 line miles for each type of disturbance. UGS (2004) estimates that buggy-mounted surveys disturb 1.2 acres/line mile, whereas helicopter-acquired data disturbs only 0.007 acres/line mile.

Thus the total disturbance is $(300 \times 1.2) + (300 \times 0.007) = 360 + 2.1 = 362.1$ acres (round to **360 acres**).

Approximately 1260 square miles of Play 1907 lie within the planning area but leasing interest covers a somewhat larger total area (Fig. 1). Since the discovery of the Covenant Field several leasees have expressed interest in obtaining permits for geophysical exploration on BLM lands. Interest in geophysical surveys on private lands in the play area will increase in a similar manner. At this point it is not clear how much of the work will be conducted by buggy and how much by helicopter nor how much will be 2-D or 3-D. Some surveys will probably be by vibroseis. Early discussions indicate that we can expect several hundred miles of seismic surveys during the next few years on BLM and private lands. We are estimating an average of 250 miles of survey per year over the 15 year period being considered. Activity in the near future may exceed this average but is likely to decrease later in the cycle. If most of the surveys are buggy-mounted the total disturbance in Area 4 would be **4,500 acres** (3750 miles x 1.2 acres/mile).

Few surveys are expected in the remaining parts of the planning area (Areas 1 and 2) based on past activity and current interest. A total of 200 miles of geophysical survey is proposed for the 15 year time period resulting in **240 acres** of disturbance.

Surface disturbance from **geophysical surveys = 360 + 4500 + 240 = 5100 acres.**

Wells

Forty nine wells are projected for Area 3 (Wasatch Plateau). Utah Geological Survey (2004) assumed a drill pad of 2 acres and 5 miles of road (4 acres/mile) for each well in the Fishlake National Forest. Using these values the 49 projected wells would impact approximately **1100 acres**. Areas 1, 2 and 4 are projected to contain 405 wells but many of the wells in Area 4 would probably be directional wells from a single drill pad. Assuming an average of 3 wells/pad in Area 4 results in 120 pads. The 45 wells in Areas 1 and 2 are assumed to be single well pads giving 165 total pads. Using a pad size of 4 acres plus 2 miles of road at 4 acres/mile would result in a surface disturbance of **1980 acres**.

Surface disturbance from **drilling 454 wells = 1100 + 1980 = 3080 acres**.

Total Surface disturbance from all activity (geophysical surveys and wells) = 5100 + 3080 = 8180 acres.

The disturbance estimated above will be future disturbance during the 15 year life of the plan. Present disturbance is minimal and past disturbance is largely reclaimed. Disturbance associated with future nonproductive wells should be reclaimed within 3 to 4 years after the well is plugged and abandoned.

Tar Sands

The unconventional resource contained in the Tar Sand Triangle Special Tar Sand Area (STSA) received considerable industry interest in the late 1970s and early 1980. Applications were received to convert existing oil and gas leases to combined hydrocarbon leases under the terms of the Combined Hydrocarbon Leasing Act of 1981. An EIS was begun by the BLM and National Park Service to consider the applications but it was never completed and the conversions are still pending. No wells are projected for exploration or development because of the unfinished EIS, the uncertain future of oil sand as an economic resource and the belief that any proposed activity would not follow conventional oil and gas techniques and would be better considered in a site specific NEPA document.

Bibliography

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Statement of Qualifications

This RFD was prepared by James Fouts, Geologist in the Utah BLM State Office. He has B. S., M. S. and Ph. D. degrees in geology and has worked for Shell Oil Co., Essex International Corporation, Auburn University, U. S. Bureau of Mines Salt Lake City Research Center, U. S. Geological Survey, U. S. Minerals Management Service. Westminster College and Salt Lake City Community College.

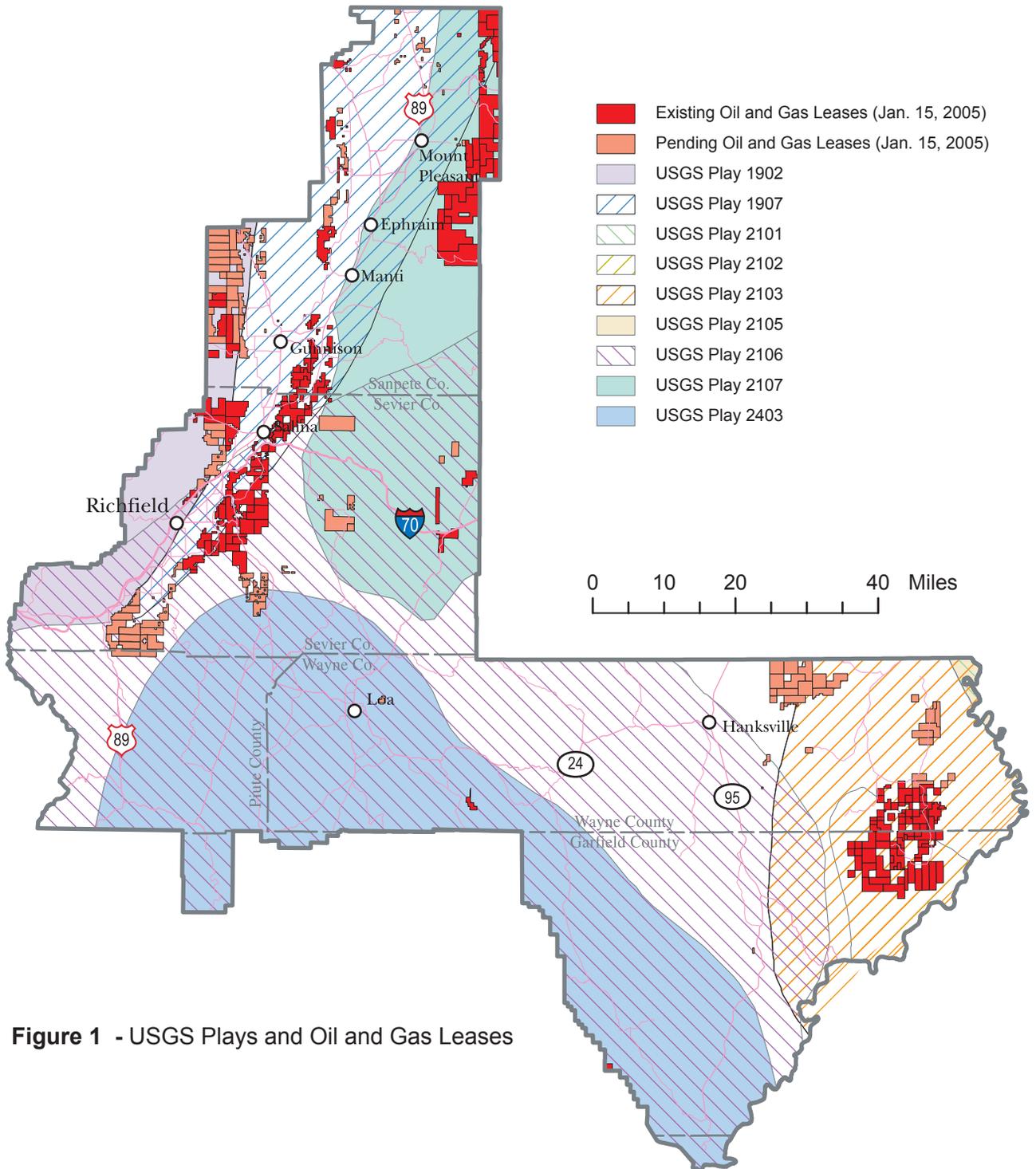


Figure 1 - USGS Plays and Oil and Gas Leases

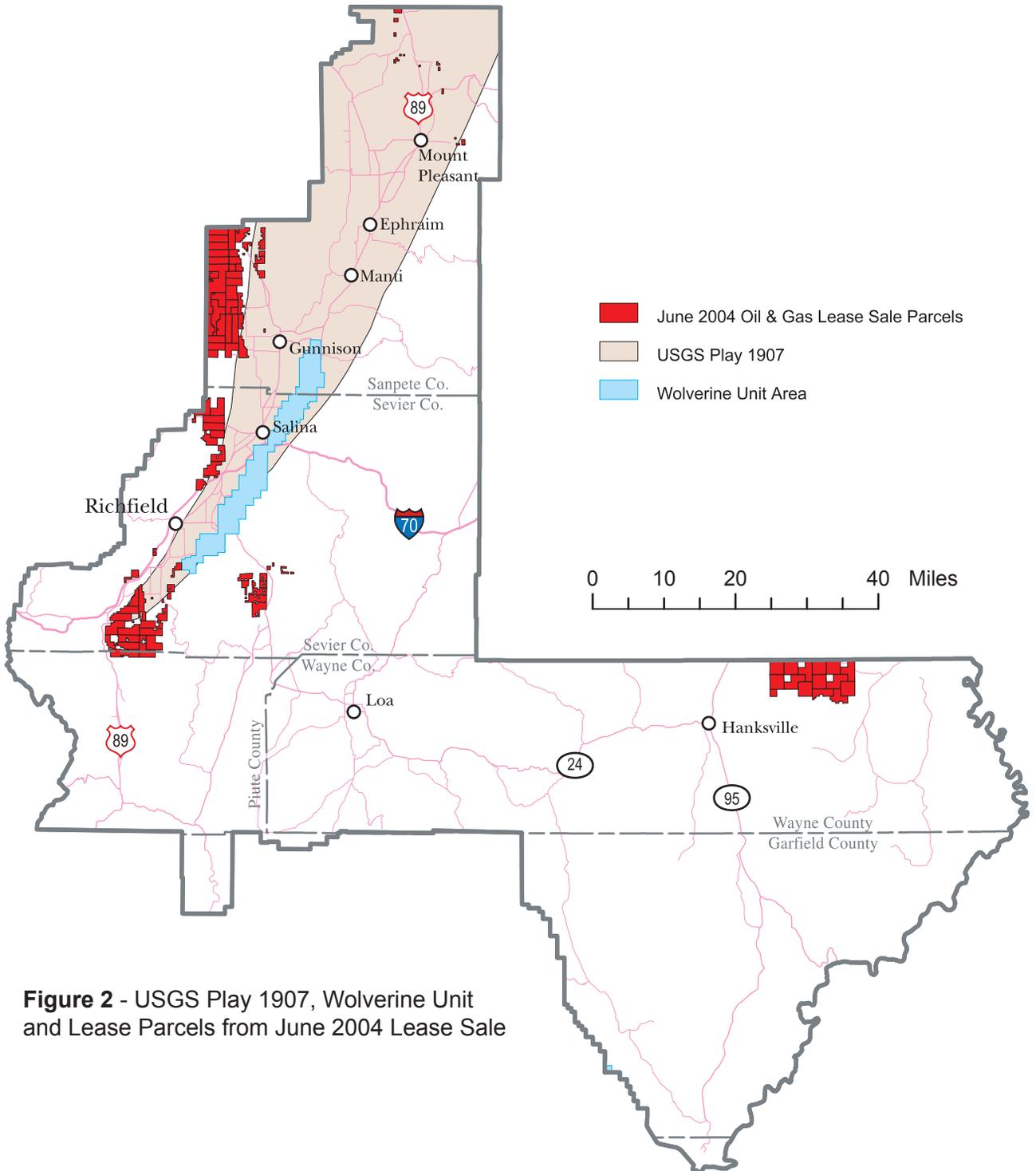


Figure 2 - USGS Play 1907, Wolverine Unit and Lease Parcels from June 2004 Lease Sale

Figure 3 is displayed on page 6 of this document.

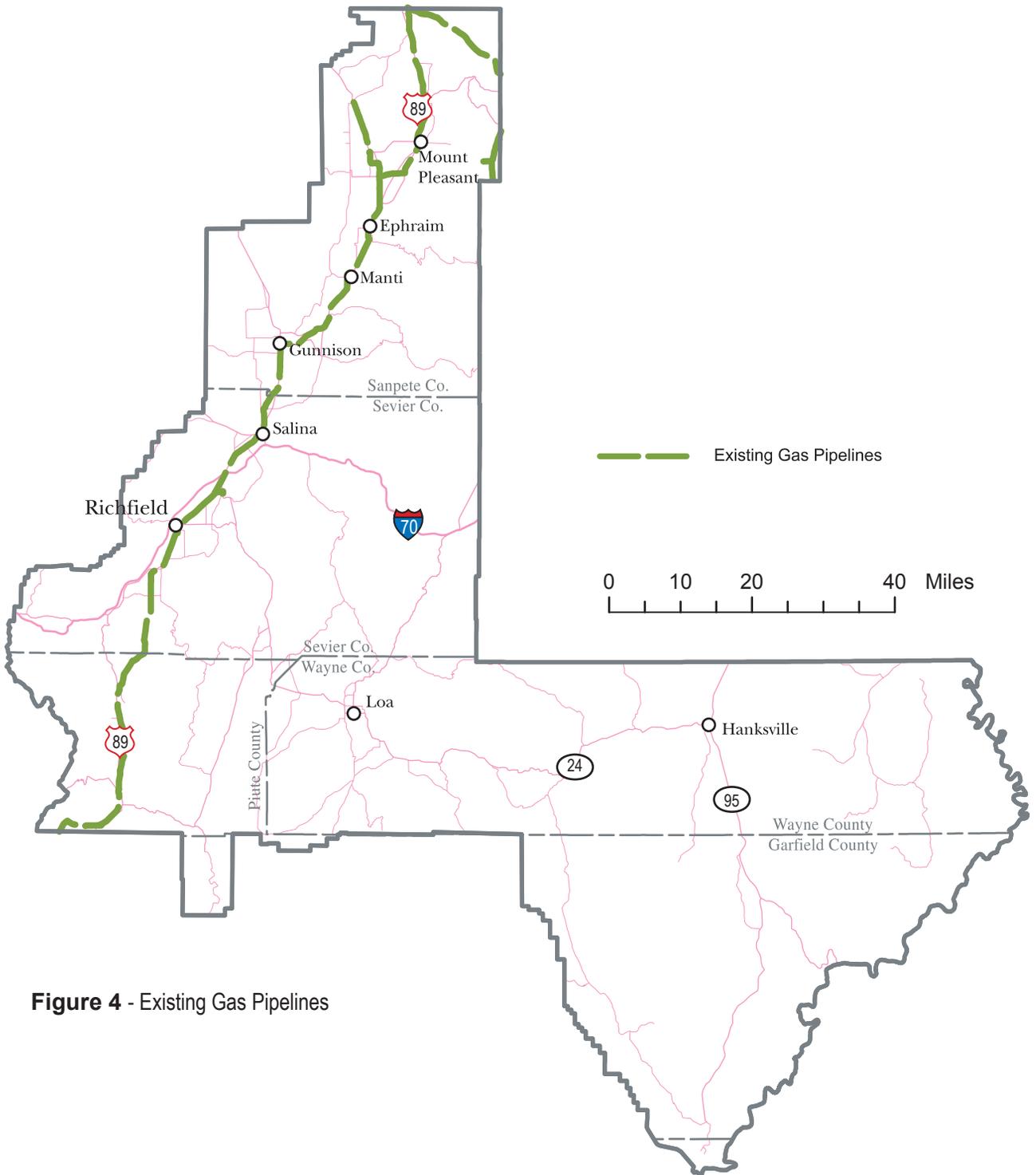


Figure 4 - Existing Gas Pipelines

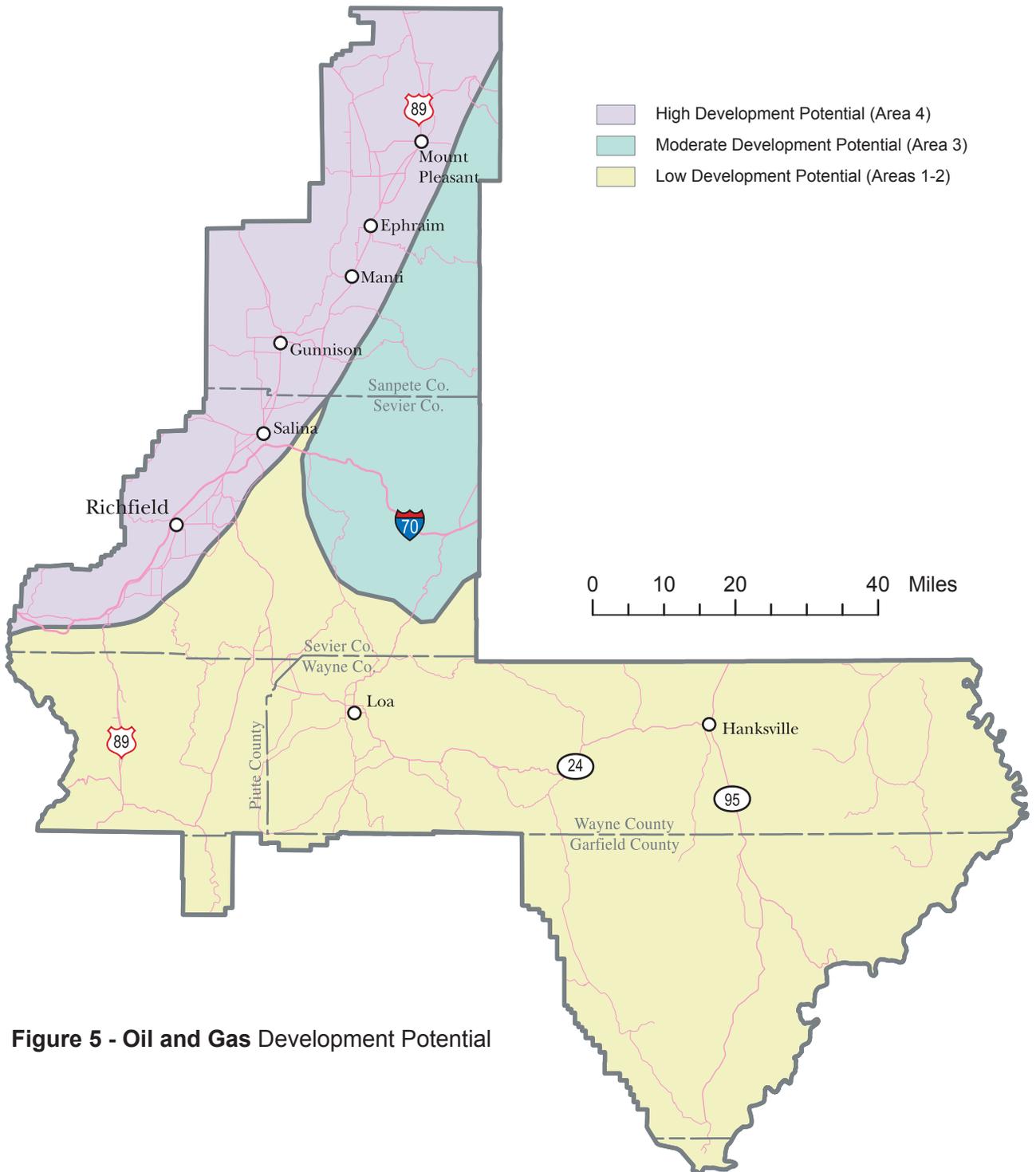


Figure 5 - Oil and Gas Development Potential