
Appendix R

Oil and Gas Reasonably Foreseeable Development
Scenario for Greater Sage-Grouse Occupied
Habitat in Utah Sub-Region

APPENDIX R

OIL AND GAS REASONABLY FORESEEABLE DEVELOPMENT SCENARIO FOR GREATER SAGE-GROUSE OCCUPIED HABITAT IN UTAH SUB-REGION

INTRODUCTION

This Reasonably Foreseeable Development Scenario is a required component of the GRSG LUPA/EIS and addresses potential oil and gas exploration and development over the next 15 years, and its resulting potential impact on leasing and development of federal and nonfederal lands and/or mineral rights within occupied GRSG habitat in Utah. Within Utah, GRSG habitat is located in 13 large scattered areas, identified as population areas, and is concentrated in a north-northeast trending line from eastern Iron County in the south to Daggett County in the north. Each area contains lands managed by a variety of agencies, including the BLM, Forest Service, State of Utah, and the Ute Tribe, as well as fee lands. This Reasonably Foreseeable Development Scenario applies primarily to BLM-administered and Forest Service-administered lands and split-estate underlain by federal minerals, although it takes into consideration nonfederal development in the cumulative impact analysis.

This Reasonably Foreseeable Development Scenario generally follows the procedures outlined in BLM Instruction Memorandum 2004-089, Policy for Reasonably Foreseeable Development Scenarios for Oil and Gas. It projects a baseline scenario of activity assuming 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. Under these conditions, this Reasonably Foreseeable Development Scenario provides a maximum development scenario. The effect of the alternatives on potential development is also included in this scenario.

Oil and gas occurrence potential (as shown on **Map 3.20-2**, Oil and Gas Occurrence and Development Potential; **Appendix A**) is one of several criteria used to project future oil and gas activity in GRSG occupied habitat. Other criteria include past, present and future (APDs) oil and gas activity within and near GRSG occupied habitat, existing oil and gas leases and

expressions of interest, exploration and development trends, seismic surveys, existing infrastructure, and commodity prices. GRSG occupied habitat within each population area is addressed below generally from the lowest oil and gas potential to the highest. Information detailing the proposed oil and gas development wells for alternatives are detailed in **Table R.1**, Predicted Number of Wells Drilled by Alternative in Each Population Area and County, and **Table R.2**, Predicted Number of Producing Wells by Alternative in Each Population Area and County, at the end of this appendix.

In order to assess potential oil and gas development, a Microsoft Excel spreadsheet was compiled with existing oil and gas data from the Utah Department of Oil, Gas, and Mining. The Utah Department of Oil, Gas, and Mining data were then intersected with the GRSG occupied habitat shape file. This resultant data set was exported into Microsoft Excel and queried first by population area and then by county to determine potential impacts at the county level. Data partitioned by county includes percentage of population area acreage within each county, number of federal and nonfederal producing oil and gas wells, federal and nonfederal number of shut-in oil and gas wells, mineral ownership, applications for permit to drill, plugged and abandoned wells, and plugged and abandoned dry holes. The majority of these attributes were also partitioned into priority and general habitat within the GRSG occupied habitat of each population area. This data were then analyzed spatially in ArcMap 10.0 (GIS) for proximity to oil and gas fields and units to estimate well county locations.

This Microsoft Excel and GIS data were then analyzed with respect to the number of wells in the Reasonably Foreseeable Development Scenario to determine the likelihood of success, location, and federal or nonfederal mineral interest, and whether a well is anticipated to be drilled on existing or new leases.

Resulting from this analysis, little or no impact is anticipated in the Bald Hills, Box Elder, Hamlin Valley, Ibapah, Lucerne, Panguitch, Parker Mountain, Sheeprocks, Wyoming Blacks Fork, and Wyoming Uinta Population Areas due to low oil and gas potential and/or lack of existing oil or gas production. Only two of the population areas are anticipated to have significant development on federal minerals: Carbon and Uintah-Diamond Mountain. Predicted development for individual population areas is described below.

BASELINE REASONABLY FORESEEABLE DEVELOPMENT SCENARIO BY POPULATION AREA

Ibapah

The Ibapah Population Area is located in the west-central portion of the state bordering Nevada, approximately 17 percent of which is located in Juab County and 83 percent of which is in Toole County. The majority of mineral interest in Toole County is federal, while 100 percent of the mineral interest in Juab County is nonfederal (95 percent tribal and 5 percent fee). There are no existing leases, producing wells, or plugged and abandoned wells in occupied habitat or this population area. Therefore, there is little prospect for development in the near future, and no wells are projected.

Box Elder

Most parts of the Box Elder Population Area are underlain at depth by rocks that have been metamorphosed to some degree. Shallower units contain a high percentage of volcanic material,

and the occurrence potential map reflects this basic geology by rating the area as having a low potential for oil and gas occurrence. A few past seismic surveys have been run, and six federal oil and gas leases are located in the southeastern part of the habitat area. Four wells have been drilled in the extreme northwestern part of the occupied habitat area. Five other dry holes are in the northeastern end of the occupied habitat. The geology of the area and past activity indicate that little exploration is expected in the next 15 years; therefore, no wells are projected.

Lucerne

The Lucerne Population Area borders Wyoming in the northeast portion of Utah, with approximately 36 percent of the acreage in Summit County and 64 percent in Daggett County. The majority of mineral interest in this population area is nonfederal (fee and state), with federal mineral interest at approximately 30 percent, of which 14 percent is located within two existing leases. There are no producing wells. There are seven plugged and abandoned wells inside occupied habitat of this population area, but outside existing federal leases. Although there are numerous wells just north of the Utah state line in Wyoming, none are producing in the vicinity of this Population Area; therefore, no wells are projected for this population area.

WY Black Fork

The entire WY Black Fork Population Area is within occupied habitat. Only the northeast corner of the population area is under federal lease (WYW 146527), which is entirely within general habitat. Four wells have been drilled in this population area and all wells have resulted in dry holes that were plugged and abandoned. The majority of the Wyoming Black Fork population area includes the Flaming Gorge National Recreation Area. Recreation is the focal activity within the region. Past activity indicates little future exploration is expected in the next 15 years; therefore no wells are projected for this population area.

Hamlin Valley

The Hamlin Valley Population Area is located in southwest Beaver County and northwest Iron County along the Nevada state line. It is composed of federal lands with scattered State of Utah sections. No leases have been issued, and no oil and gas wells have been drilled in GRSG occupied habitat or within the population areas, but several dry holes are located north of this population area. Seismic surveys have been run north, east, and south of the area, and a couple of lines extended for short distances inside the occupied habitat. A cluster of active oil and gas leases is located 50 miles to the southeast. The mineral occurrence potential map indicates a low potential for oil and gas occurrence.

Predicting future exploration or development in lightly explored areas, such as Hamlin Valley, is difficult. Experience has shown that it is usually better to err on the high side than on the low side to be prepared for any activity that might occur, however unlikely it may be. For this reason, only one exploration well is projected in the occupied habitat in the Hamlin Valley population area during the next 15 years, which from surrounding historical drilling data may result in a dry hole. The minimal surface disturbance resulting from one well should be reclaimed within 5 years after abandonment.

Bald Hills

The Bald Hills Population Area is located approximately 150 miles due east of the Hamlin Valley population area. It includes BLM-administered lands, scattered State of Utah lands, and a small amount of fee lands. Several miles of seismic lines cover the northern portion of the population area, and a few were run in the south. The lease cluster described above covers the southeast one-third of the Bald Hills Population Area. There are four dry holes in the population area, three on federal lands and one on fee lands. There are no wells in occupied habitat. The oil and gas occurrence potential map shows the southeastern 90 percent of the occupied habitat as having moderate potential for oil and gas occurrence, although no data are given to support this classification.

Approximately 78 percent of the occupied habitat is underlain by federal minerals, of which 50 percent is leased. This large cluster of active oil and gas leases indicates a successful attempt to secure the right to explore and possibly develop this area sometime in the future. For the above reasons, two exploration wells are projected to be drilled in occupied habitat during the next 15 years. The wells would result in little surface disturbance, and if dry holes result as projected, they could be rehabilitated within approximately 5 years after abandonment.

Panguitch

The Panguitch Population Area shares a common boundary with the east side of the Bald Hills Population Area and extends approximately 350 miles to the south. It includes BLM, Forest Service, fee, and State of Utah lands. Approximately 72 percent of occupied habitat is federal mineral estate. A cluster of federal leases at the extreme northern end of the area covers approximately 12,150 acres. Two other leases, 36 miles to the south, include 3,500 acres. Seismic survey lines are sparsely scattered throughout the occupied habitat in this population area, but an area of closely spaced lines is present on mostly fee lands in the northeastern part of the unit.

Two plugged and abandoned wells are inside the occupied habitat area, and five other plugged and abandoned wells are within the population area. With the exception of a small moderate potential area at the northwestern tip, the occupied habitat in the Panguitch population area is rated as having a low potential for oil and gas occurrence.

It is projected that two exploration wells would be drilled in GRSG occupied habitat during the next 15 years that may result in dry holes. This is based on the relatively large size of the area, the existence of seismic lines and active leases, and the seven plugged and abandoned wells. The nearest producing oil or gas wells are approximately 30 miles to the east. As in the previous discussions, the limited surface disturbance should be reclaimed within 5 years after the wells are plugged and abandoned.

Parker Mountain

Numerous seismic surveys have been run at the southern end of the Parker Mountain Population Area, along the northwestern corner of Bryce Canyon National Park. Another area of dense coverage is located on a large block of State of Utah lands near the center-east of the unit. Although there is 70 percent federal mineral ownership, less than 2 percent is leased within occupied habitat. The handful of federal leases has no obvious spatial pattern. A total of 28

plugged and abandoned wells are located within this population area, with 21 (2 fee, 3 state, and 16 federal) within GRSG occupied habitat, and 7 outside of occupied habitat (4 federal and 3 fee). The producing Upper Valley Oil Field is approximately 75 miles to the southeast, and known occurrences of carbon dioxide gas are in an area about 140 miles to the east. The oil and gas occurrence potential map shows the area as having a low potential for oil and gas occurrence, except for a very small area at the unit's extreme northwestern tip.

Only one exploration well is projected to be drilled in occupied habitat within the Parker Mountain population area during the next 15 years because of the low occurrence potential rating, the current limited interest in the area, the absence of infrastructure, and the 21 plugged and abandoned wells. It is also possible that carbon dioxide gas, produced by magmatic activity north of the occupied habitat, has flushed hydrocarbons from the area. Surface disturbance by the single well should be reclaimed within 5 years after it is plugged and abandoned.

Sheeprocks

The Sheeprocks Population Area consists of BLM, Forest Service, fee, US Department of Defense, and scattered State of Utah lands. Several seismic survey lines cross the area, especially in the northern part of the GRSG occupied habitat area and along the eastern boundary farther to the south. Clusters of oil and gas leases are present in the northeastern, southwestern, and southern portions of the GRSG occupied habitat, and these areas are classified as having moderate potential for the occurrence of oil and gas.

Six plugged and abandoned wells (two BLM, three fee, and one US Department of Defense) are inside occupied habitat, with relatively few located in the surrounding area. There has been only minor interest in exploring this area in the past. Based on this history and the absence of current activity, relatively minor activity is predicted for the life of this Reasonably Foreseeable Development Scenario. The occurrence potential map shows two separate moderate potential areas in the Sheeprocks occupied habitat, and two new wells are projected, one in each of the moderate potential areas, during the next 15 years. The nearest major oil and gas production (not related to small structures such as the Covenant Field) is approximately 50 miles to the east.

WY Uinta

The northern portion of the WY Uinta Population Area is occupied habitat, which is predominantly general habitat. Development within occupied habitat has occurred only along the eastern portion on federal leases. Sixteen wells have been drilled in this population area, of which five are shut in (two gas and three oil). Four wells have been plugged and abandoned. Currently there are two producing gas wells and five producing oil wells on federal leases. Past and current activity indicates minimal future development is expected in this population area over the next 15 years, with four wells being projected, all on federal minerals.

Rich

The Rich Population Area includes one of the most productive areas in Utah's recent oil and gas history, the Wyoming Overthrust Belt. Oil and gas were first discovered at the Pineview Field in Wyoming in the 1970s, but three oil fields and three gas fields have been developed in Utah.

Some of the fields are still producing small amounts of oil and gas, but little new drilling has occurred.

Numerous seismic surveys have been run, especially in the southern part of the area, and most of the available federal lands are under lease. Past drilling is also concentrated in the southern part of the area, but several wells have been drilled farther to the northwest with some shows and small amounts of production. The occurrence potential map indicates that most of the area is rated as high.

The Reasonably Foreseeable Development Scenario completed in 2012 projected 35 new wells in the next 15 years. Federal mineral ownership within GRSG occupied habitat is approximately 25 percent, of which 16 percent is leased.

Emery

The Emery Population Area is directly north of the Parker Mountain population area along the eastern side of the Wasatch Plateau and is almost entirely on Forest Service-administered lands. Less than half of this population area is occupied habitat. Approximately 89 percent of GRSG occupied habitat is federal mineral estate, of which 18 percent is leased. A cluster of federal oil and gas leases covers the northwest prong of the GRSG occupied habitat, and there are 3 federal oil and gas exploratory units including, from west to east, Skyline II, Middle Mountain, and the productive East Mountain Unit. A few other federal leases are scattered throughout the GRSG occupied habitat. The Clear Creek Unit is a short distance to the north and has been actively producing natural gas for over 50 years. Relatively few seismic surveys have been run in the Emery Population Area, possibly because of the rugged topography on the east flank of the Wasatch Plateau. A total of 29 plugged and abandoned wells are located within this population area, with 24 (4 fee; 1 state; and 19 federal, of which 10 are BLM and 9 are Forest Service) within GRSG occupied habitat and 5 outside of occupied habitat (2 Forest Service and 3 fee). There are seven producing gas wells (two BLM, three Forest Service, and two state) and three shut-in gas wells (one BLM and two Forest Service) outside of GRSG occupied habitat near the eastern boundary of the population area. Numerous natural gas wells are located just outside the eastern boundary and comprise the Drunkards Wash Coal Bed Methane Gas Field on the north, the Buzzard Bench Field in the center, and the Ferron Field to the south. These wells are about equally split between BLM and State of Utah lands with a very small number on Forest Service-administered lands.

The occurrence potential map shows most of the Emery Population Area as moderate or low potential with a very small amount of high potential. Although much of the population area has moderate potential for natural gas occurrence, the development potential is considerably less because much of the area includes the steep, rugged eastern slope of the Wasatch Plateau. The western portion of the area is atop the plateau, where topography is less rugged, but still difficult to access. Also, the hydrocarbon reservoirs that are producing to the east are much deeper under the Wasatch Plateau, which increases well drilling costs. These factors would limit the number of wells drilled in the GRSG occupied habitat to the extreme eastern portion of the plateau, with the possibility of a few more wells on top. It is possible that directional or horizontal drilling technology would be used to test under the eastern slope of the plateau, especially if the price of natural gas increases.

It appears the area is being developed on 160-acre spacing with numerous undrilled areas, but most of these are outside the GRSG occupied habitat areas. Very few wells are on Forest Service-administered lands, but some of the areas have producing wells to the north and south, indicating that the coal beds are continuous and underlie the easternmost Forest Service-administered lands. Some of the areas should be accessible for drilling rigs. Based on the existing well spacing, the topography, and access, a conservative projection is 35 new pads during the next 15 years, with one well per pad for a total of 35 wells. Some roads and pipelines are already present.

Strawberry

The western portion of the GRSG occupied habitat in the Strawberry Population Area covers Forest Service-administered lands, whereas the eastern portion is mostly fee and State of Utah lands. Forest Service-administered lands immediately west of the GRSG occupied habitat are crossed by seismic survey lines and covered by federal leases, both of which extend into the western and southwestern portions of the population area. Thirteen plugged and abandoned wells are scattered throughout the area, and four state-approved applications for permit to drill are in the southeast corner of the GRSG occupied habitat on fee lands. The applications for permit to drill are an extension of active development to the east, and drilling will likely continue to move west and southwest. Oil and gas occurrence potential is rated as high in the east and as moderate in most other areas.

The west-southwest advancement of drilling could move across the southern half of the GRSG occupied habitat in the Strawberry population area, assuming that geological conditions remain similar. If the southern part of the area is fully developed as spaced (2 wells per section), approximately 290 wells would be drilled. If one quarter of these wells are drilled in the next 15 years, the total would be approximately 75 new wells. If only the GRSG occupied habitat is considered, a reasonable projection is 60 wells drilled during the next 15 years. The first wells would likely be completed on fee lands in the eastern portion of the area where several applications for permit to drill have already been approved by the state.

The Forest Service signed the Record of Decision for Oil and Gas Leasing on the Uinta-Wasatch-Cache National Forest in October 2011. Approximately 736,070 acres were made available for leasing; however, the majority of that acreage has an NSO stipulation. The Reasonably Foreseeable Development Scenario for this Final Supplemental EIS predicted that 12 wells would be drilled. Prior to this Final Supplemental EIS, 67 authorized federal leases were suspended as a result of litigation. The Record of Decision states that, "Any decision by the BLM to lift the suspensions on these leases will be consistent with the Forest Service Letter of Consent after the Forest Service has ensured that the leases are in accordance with the terms and conditions for leasing identified in the decision described Uinta National Forest Final Supplemental EIS and Record of Decision," which includes complying with the new stipulations in Appendix G of that Final Supplemental EIS. Due to the constraints to leasing and development mentioned above, little activity is expected on Forest Service-administered lands.

Carbon

The Carbon Population Area consists of roughly equal amounts of fee and BLM-administered lands, several townships of Forest Service-administered lands, and scattered State of Utah lands.

Fee lands are concentrated in the central and western portions, and the eastern part is largely BLM-administered land. A significant portion of the population area is not GRSG occupied habitat.

The western end of the GRSG occupied habitat area is sparsely covered by seismic survey lines, but no federal leases are present. Scattered federal leases, some on split-estate lands, are in the central part of the area, and most of the large block of federal lands in the east is under lease. There are several federal oil and gas exploratory units in the east, including the Prickly Pear and most of the Peter's Point Units. These are mentioned because they have been locations of very active drilling programs in the recent past.

Most of the production has been from BLM-administered lands included in federal units near the eastern edge of the habitat area, but approximately 50 coalbed methane gas wells have been drilled in the Castlegate Field near the habitat's center. The large Helper and Drunkards Wash coalbed methane gas fields are a short distance to the south where the latter occupies a small area of GRSG occupied habitat.

Future drilling levels are difficult to predict. Well spacing in the coalbed methane gas areas is typically 160 acres per well, but spacing of the sandstone reservoirs in the Prickly Pear and Peter's Point Units has been as dense as 10 acres per bottom hole location. These two units are approaching full development, but Bill Barrett Corporation has proposed a new federal unit immediately north of Prickly Pear. A major infill drilling program is possible in the coalbed methane gas fields, which could extend activity in them. Other areas where drilling could occur during the next 15 years are in the extreme northern part where development on Ute tribal lands may spread into the occupied habitat, and on the Wasatch Plateau in or near existing units.

Two recent EISs cover the eastern end of the Carbon population area. Gasco's EIS (BLM 2012a) and Bill Barrett Corporation's West Tavaputs Plateau EIS (BLM 2010) propose development in the northeast and east-central portions of the population area. The combined proposed federal actions include a total of 1,063 well pads.

There are 575 proposed well pads (1,298 wells) in the Gasco EIS (BLM 2012a) area, of which 24 percent are within GRSG occupied habitat. All are located in Duchesne County, resulting in approximately 140 well pads (391 wells). In the West Tavaputs Plateau EIS (BLM 2010), there are 120 proposed and existing well pads (626 wells), located in Carbon County, 100 percent of which is within GRSG occupied habitat.

Two other areas in the Carbon Population Area are being developed. One is along the northern boundary where development in the Brundage Canyon Field is moving south and west into the population area. Projecting this pattern into the future indicates that approximately 256 well pads (1 well per pad) would impact GRSG occupied habitat. A large number of wells have been drilled inside the population area along its southern border by the development of the Drunkards Wash and Gordon Creek Fields. At least 1 township of occupied habitat would be impacted by 144 wells and associated activity. A total of 1,417 wells are predicted to be drilled from 660 pads within the GRSG occupied habitat of this population area.

Uintah-Diamond Mountain

The Uintah-Diamond Mountain Population Area consists of three discreet areas: a Southern Lobe in southern Uintah County and northern Grand County, which includes mostly BLM and tribal lands; a smaller lobe on the Utah-Colorado border (Eastern Lobe) in central Uintah County, including BLM and State of Utah lands; and a large east-west area extending from central Duchesne County to the northeastern corner of Utah (Northern Lobe). The latter area includes tribal, fee, BLM, state, and Forest Service-administered lands.

The Southern Lobe contains relatively few seismic lines. The northern portion of this lobe has significant gas production in the Natural Buttes, Hill Creek, Love, and Bitter Creek Fields, primarily within the Natural Buttes, Love, and Little Canyon Units. The eastern portion of this Southern Lobe is largely leased; however, there is little production. The remaining majority of producing gas wells are located in the west-central portion of this Southern Lobe, primarily in two gas fields, Flat Rock and Naval Reserve Fields, in the Hill Creek Extension of the Uintah-Ouray Reservation, which is all tribal minerals. There is very little development in the westernmost portion of this lobe. However, just east of the Flat Rock Field is the Tumbleweed Unit (federal minerals).

The small lobe along the Utah-Colorado border (Eastern Lobe) has moderate seismic coverage and oil and gas leases in the western half. Producing gas wells cover the southwestern part of the area (Natural Buttes, Big Valley, and Devil's Playground Fields), and producing oil and gas wells are in the northwestern part, primarily in the Red Wash Field. These two areas will likely experience the largest increased development.

The Northern Lobe has the largest area of GRSG occupied habitat, from Duchesne County to Daggett County, has fairly dense seismic coverage in the southeast corner, and moderate to sparse coverage in other parts. The area east of the Uinta Mountains has the least coverage. Federal leases exist in the northeast corner of Utah along the Wyoming border, northwest of Dinosaur National Monument, and directly north of the Natural Buttes Fields. Farther to the west, on the Uintah-Ouray Reservation, tribal leases are abundant near the west end of GRSG occupied habitat. Oil wells are present in the central lobe of the Northern Lobe in Duchesne County, and widespread applications for permit to drill indicate that drilling will continue. Numerous oil wells cover the southern and western ends and drilling will continue in these areas, but little drilling is anticipated to occur in the northeastern corner during the next 15 years. The occurrence potential map paints a similar picture of the area.

Several recent recently approved for ongoing EISs in the area propose to construct a total of 5,000 well pads, 1,020 miles of roads, and 2,000 miles of pipeline. Three of the largest project areas (Monument Butte, Greater Natural Buttes (BLM 2012b), and North Chapita Wells) include little or no GRSG occupied habitat. When these projects are removed, the number of pads is reduced to 1,075, the miles of roads to 225, and the miles of pipeline to 440. There are 53 recently approved applications for permit to drill in the western part of the GRSG occupied habitat in Duchesne County on predominantly tribal and bee lands, which indicates activity in this area will continue to cause surface disturbance. However, none of these applications for permit to drill are on federal mineral interest, which is less than 2 percent of the GRSG occupied habitat in this area and does not influence this Reasonably Foreseeable Development

Scenario analysis. A conservative projection is 570 pads for a total of 1,635 wells in GRSG occupied habitat.

REASONABLY FORESEEABLE DEVELOPMENT SCENARIO BY ALTERNATIVE

Restrictions on oil and gas development that are being considered under Alternatives B, C, D, and E in this LUPA/EIS have the potential to reduce the number of wells that could be drilled under each alternative. **Table R.1**, Predicted Number of Wells Drilled by Alternative in Each Population Area and County, and **Table R.2**, Predicted Number of Producing Wells by Alternative in Each Population Area and County, at the end of this appendix include information on the number of wells expected in occupied GRSG habitat under each alternative.

Development from Existing Leases

When calculating how the Reasonably Foreseeable Development Scenario would vary under each alternative, it was assumed that the same level of development will occur on valid and existing rights under each alternative. The BLM made this assumption despite the fact that Alternatives B, C, and to a lesser extent, D, would add required design features as conditions of approval (e.g., a 4-mile NSO around occupied GRSG leks) to applications for permit to drill on existing leases. The BLM determined that this was a reasonable assumption for the following reasons:

1. When only portions of the lease are within 4 miles of an occupied GRSG lek, lease holders will likely be able to access mineral resources within 2 miles by directional drilling from lands outside the 4-mile buffer.
2. The majority of the Reasonably Foreseeable Development Scenario is proposed on existing leases that are currently held by production. Lease holders would be able to directionally drill from existing well pads located on both federal and nonfederal land that are within 4 miles of an occupied GRSG lek.
3. Operators would be able to access nearly all federal minerals within 4 miles of a GRSG lek by drilling from existing or new well pads on state and private lands.
4. In the rare circumstance where there are leases entirely contained within 4 miles of a GRSG lek, there are no existing well pads that could be used for directional drilling, and there are no state or private lands from which federal minerals could be accessed, then the BLM could impose conditions of approval but cannot deny lease holders reasonable access to the lease.

To determine whether the abovementioned analysis assumption was valid, a GIS exercise was conducted, which is explained as follows.

1. For fluid mineral leasing, the most restrictive condition of approval that would be applied to existing leases is a 4-mile NSO. Because this is the most restrictive condition of approval, it was used as the basis of the GIS exercise.
2. It was assumed that through directional drilling technology, it is possible to reach approximately 2 miles from a surface location. While there are many variables that determine the feasibility of directional drilling, given the improvements in technology

that have occurred during the past 10 years, it was determined that this is a reasonable assumption for the next 15 to 20 years.

3. Based on the above assumption, it was assumed that any fluid minerals within 2 miles of a GRSG lek would, in effect, be inaccessible.
4. Using GIS, all areas within 2 miles of GRSG lek were intersected with existing leases to show the leases and their acreage that could potentially impacted.
5. Because decisions being considered in this LUPA planning process only apply to federal surface (and areas where the BLM has federal mineral interest), it was assumed that development on existing leases could still occur from state and private lands, which likely contain existing leases and/or development.
6. Using GIS, a 2-mile buffer was placed around state and private lands (again assuming that through directional drilling technology, it is possible to reach approximately 2 miles from a surface location).
7. Again, using GIS, the existing leases within 2 miles of lek were intersected with the buffered state and private lands to determine whether there are any federal lands that are within 2 miles of GRSG lek that are also inaccessible from state or private lands.
8. As a result of this exercise, it was determined that there are approximately 12,000 acres of existing leases (in an over 4-million-acre decision area) that would be inaccessible.

Given the limited amount of leased acreage that would be inaccessible (0.3 percent), it was determined that the original assumption that the same level of development will occur on valid and existing rights under each alternative is reasonable for this LUPA/EIS.

Development from New Leases

Given the assumption that the same level of development will occur on valid and existing rights under each alternative, variation in the Reasonably Foreseeable Development Scenario under each alternative is tied to potential development of new leases in GRSG occupied habitat. Included below is a summary of how the Reasonably Foreseeable Development Scenario was conducted for each alternative.

Alternative C

Under Alternative C, all GRSG occupied habitat would be designated as priority habitat. Priority habitat would be closed to fluid mineral leasing. Therefore, under this alternative, no new leases would be issued. As previously noted, land use planning decisions only apply to federal surface and areas where the BLM has federal mineral interest. While leasing and development could occur on state and private land within GRSG habitat, the interest in exploration and development of state and private land could be reduced if large areas of contiguous BLM-administered land are closed to new oil and gas leasing. The actual impact on state and private lands largely depends on land ownership patterns in an area. Under Alternative C, it was assumed that there would be no new leases issued on state or private lands in areas where there are contiguous federal lands closed to leasing.

Alternative B

Similar to Alternative C, under Alternative B, areas designated as priority habitat would be closed to fluid mineral leasing. However, different than under Alternative C, under Alternative B, not all occupied GRSG habitat would become priority habitat. Areas that are not designated as priority habitat would be designated as general habitat. General habitat would continue to be managed as it is currently. Therefore, there would be no change in Reasonably Foreseeable Development Scenario from new leases in general habitat. In order to calculate the reduction in wells that would occur under this alternative, the BLM used the same methodology that was used to calculate the Reasonably Foreseeable Development Scenario under Alternative C, plus one additional step. From the Alternative C numbers, the BLM multiplied the number of wells projected on new leases in occupied habitat by the percent of lands within each county that have high oil and gas potential and would be designated as priority habitat. This exercise shows that impacts would vary by county. For example, comparing two of Utah's largest producing counties, 83 percent of the occupied GRSG habitat in Carbon County that would be designated as priority habitat has high oil and gas potential, whereas only 13 percent of the GRSG occupied habitat in Uintah County that would be designated as priority habitat has high oil and gas potential.

Alternative D

With regards to designating priority habitat, in areas where oil and gas development is anticipated, there is no difference between Alternatives B and D. However, under Alternative D, no new areas would be closed to fluid mineral leasing. Rather, major constraints (NSO) would be placed on development within 4 miles of an occupied GRSG lek. To calculate the Reasonably Foreseeable Development Scenario under Alternative D, the BLM used the same methodology that was used to calculate the number of wells that would be drilled under Alternatives B, plus two additional steps.

As part of step one, the BLM multiplied the number of potential wells on new leases in priority habitat by the percent of priority habitat that would be NSO. It was assumed that there would be no reductions in development in priority habitat where there are minor constraints (CSU and TL).

Restrictions on surface occupancy (NSO) are not equivalent to closure. To ascertain the number of wells that would be foregone in areas where there are major constraints (NSO), the BLM again applied the assumption that if a 4-mile buffer were placed on occupied GRSG leks, areas within 2 miles would be inaccessible given current drilling technology. Based on this assumption, step two consisted of multiplying the number of potential wells on new leases in priority habitat that are also in areas that would be NSO by 25 percent. Twenty-five percent was used because it is the percent of lands within a 4-mile area that could effectively be closed by an NSO restriction.

Alternative E

Alternative E is based on the State of Utah's 2013 Conservation Plan for Greater Sage-grouse in Utah (State of Utah 2013). Under Alternative E, BLM-administered lands inside of GRSG management areas within one mile of an active lek would be subject to major constraints (NSO). GRSG habitat outside of the 1-mile lek buffer would be subject to minor constraints

(CSU and TL). It is not anticipated that this would result in any changes in the Reasonably Foreseeable Development Scenario. Therefore, the same numbers of wells predicted under Alternative A are also predicted under Alternative E.

SURFACE DISTURBANCE ESTIMATES

Table R.3, Estimated Surface Disturbance: Alternatives A and E, through **Table R.6**, Estimated Surface Disturbance: Alternative D, provide information on estimated surface disturbance under each alternative. These tables are organized by both population area and county. Changes in disturbance are directly proportional to the number of well pads expected under each alternative. Surface disturbance estimates are based on previous experience with oil and gas development in the planning area. It is assumed that all future seismic surveys would use buggies rather than helicopters, and the associated disturbance would be 1.2 acres per mile. Surface disturbance resulting from road construction was calculated using a value of 6 acres per mile, and pipelines were assumed to disturb a width of 50 feet. Well pads in Utah, Wyoming, and Colorado were studied in detail and ranged from 1 to 5 acres per pad. The value used in this Reasonably Foreseeable Development Scenario is 4 acres per pad, but this could vary based on terrain and rig size, and whether the pad is for a single or multiple wells. Ancillary facilities include compressor stations, pumping stations, office and shop space, and other facilities that are required in a given oil or gas field. Surface disturbance estimates are outlined in **Table R.7**, Disturbance Tables.

REFERENCES

- BLM (United States Department of the Interior, Bureau of Land Management). 2010. West Tavaputs Plateau Natural Gas Full Field Development Plan Final Environmental Impact Statement and Record of Decision (add correct title). BLM, Price, Utah.
- _____. 2012a. Gasco Energy Inc. Uinta Basin natural Gas Development Project Final Environmental Impact Statement and Record of Decision BLM, Vernal, Utah.
- _____. 2012b. Greater Natural Buttes Final Environmental Impact Statement and Record of Decision. BLM, Vernal, Utah.
- State of Utah. 2013. 2013 Conservation Plan for Greater Sage-grouse in Utah. Salt Lake City, Utah.

TABLES

**Table R.1
Predicted Number of Wells Drilled by Alternative in Each Population Area and County**

GRSG Population Area	County Name	Alternatives A and E			Alternative B			Alternative C			Alternative D		
		Total Wells by County	Total Gas Wells by County	Total Oil Wells by County	Total Wells by County	Total Gas Wells by County	Total Oil Wells by County	Total Wells by County	Total Gas Wells by County	Total Oil Wells by County	Total Wells by County	Total Gas Wells by County	Total Oil Wells by County
Bald Hills	BEAVER	1		0	1	1	0	1	1	0	1	1	0
	IRON	1	0	1	1	0	1	1	0	1	1	0	1
Carbon	CARBON	770	770	0	680	680	0	662	662	0	760	760	0
	DUCHESNE	647	247	400	620	240	380	572	227	345	641	245	396
Emery	EMERY	35	35	0	35	35	0	29	29	0	35	35	0
Hamlin Valley	BEAVER	1	1	0	0	0	0	0	0	0	0	0	0
Panguitch	BEAVER	1	1	0	1	1	0	1	1	0	1	1	0
	GARFIELD	1	1	0	0	0	0	0	0	0	0	0	0
Parker Mountain	GARFIELD	1	1	0	1	1	0	1	1	0	1	1	0
Rich	RICH	25	18	7	15	10	5	15	10	5	23	23	0
	SUMMIT	10	5	5									
Sheeprocks	JUAB	1	1	0	1	1	0	1	1	0	1	1	0
	TOOELE	1	1	0	1	1	0	1	1	0	1	1	0
Strawberry	DUCHESNE	48	0	48									
	WASATCH	12	0	12									
Uintah-Diamond Mountain	DAGGETT	30	30	0	24	24	0	24	24	0	29	29	0
	DUCHESNE	150	10	140									
	UINTAH	1,455	1,318	137	1,441	1,307	134	1,347	1,220	127	1,453	1,315	138
WY Uinta	UINTA	4	1	3									
Total		3,194	2,441	753	3,045	2,317	728	2,879	2,193	686	3,171	2,428	743

Table R.2
Predicted Number of Producing Wells by Alternative in Each Population Area and County

Population Area	County Name	Success Rates (Production Potential)		Alternative B - Producing Wells			Alternative C - Producing Wells			Alternative D - Producing Wells		
		Potential for Gas Production	Potential for Oil Production	Total Wells by County	Total Production Gas Wells by County	Total Production Oil Wells by County	Total Wells by County	Total Production Gas Wells by County	Total Production Oil Wells by County	Total Wells by County	Total Production Gas Wells by County	Total Production Oil Wells by County
Bald Hills	BEAVER	10%	10%	0	0	0	0	0	0	0	0	0
	IRON	10%	10%	0	0	0	0	0	0	0	0	0
Carbon	CARBON	75%	85%	510	510	0	497	497	0	570	570	0
	DUCHESNE	75%	85%	503	180	323	429	170	259	481	184	297
Emery	EMERY	60%	60%	21	21	0	17	17	0	21	21	0
Hamlin Valley	BEAVER	10%	10%	0	0	0	0	0	0	0	0	0
Panguitch	BEAVER	10%	10%	0	0	0	0	0	0	0	0	0
	GARFIELD	10%	10%	0	0	0	0	0	0	0	0	0
Parker Mountain	GARFIELD	10%	10%	0	0	0	0	0	0	0	0	0
Rich	RICH	20%	20%	3	2	1	3	2	1	5	5	0
	SUMMIT	20%	20%	2	1	1	2	1	1	2	1	1
Sheeprocks	JUAB	10%	10%	0	0	0	0	0	0	0	0	0
	TOOELE	10%	10%	0	0	0	0	0	0	0	0	0
Strawberry	DUCHESNE	10%	10%	5	0	5	5	0	5	5	0	5
	WASATCH	10%	10%	1	0	1	1	0	1	1	0	1
Uintah-Diamond Mountain	DAGGETT	50%	50%	12	12	0	12	12	0	15	15	0
	DUCHESNE	85%	70%	107	9	98	128	9	119	128	9	119
	UINTAH	85%	70%	1,205	1,111	94	1,145	1,037	108	1,235	1,118	117
WY Uinta	UINTA	10%	10%	0	0	0	0	0	0	0	0	0
Total				2,369	1,846	523	2,239	1,745	494	2,462	1,922	541

Table R.3
Estimated Surface Disturbance: Alternatives A and E

GRSG Population Areas	Oil and Gas Potential ¹	Seismic			Well Pads							Roads			Pipelines			Ancillary Features Acres	TOTAL Dist. Acres
		Seismic Lines (Miles)	Dist. Acres	Avg. Dist./ Mi.	Total Well Pads	Federal Well Pads	Non-federal Well Pads	Avg. Dist./ Pad	Total Pad Dist. Acres	Federal Pad Dist. Acres	Non-federal Pad Dist. Acres	Roads Miles	Dist. Acres	Avg. Mi./ Pad	Avg. Dist / Mi.	Pipe-lines Miles	Dist. acres		
Hamlin Valley	L	50	60	1.2	1	1	0	4	4	4	0	10	60	10.0	6	0	0	0	124
Bald Hills	M, L	75	90	1.2	2	1	1	4	8	4	4	15	90	7.5	6	0	0	0	188
Panguitch	L, M	60	72	1.2	2	2	0	4	8	8	0	15	90	7.5	6	0	0	0	170
Parker Mtn.	L, H	65	78	1.2	1	1	0	4	4	4	0	8	48	8.0	6	0	0	0	130
Emery	H, M, L	75	90	1.2	35	31	4	4	140	124	16	40	240	1.1	6	5	30	20	520
Sheeprocks	M, L	100	120	1.2	2	1	1	4	8	4	4	15	90	7.5	6	0	0	0	218
Strawberry	M, H	120	150	1.2	60	2	58	4	240	8	232	80	480	1.3	6	75	450	20	1,340
Carbon	M, H, L	300	360	1.2	660	447	214	4	2,640	1,788	856	520	3,120	0.8	6	316	1,915	200	8,235
Uinta	H, M, L	300	360	1.2	570	450	120	6	3,420	2,700	720	420	2,520	0.7	6	855	5,215	170	11,685
Rich	H, M, L	75	90	1.2	35	13	22	4	140	52	88	80	480	2.3	6	50	125	20	855
Box Elder	L	70	84	1.2	0	0	0	4	0	0	0	0	0	0.0	0	0	0	0	84
WY Uinta	M,H	10	12	1.2	4	3	1	4	16	12	4	10	60	2.5	6	5	30	10	128
STATEWIDE TOTAL		1,300	1,566		1,372	952	421		6,628	4,708	1,924	1,213	7,278			1,306	7,765	440	23,677

¹ L=low, M=moderate, H=high

Table R.4
Estimated Surface Disturbance: Alternative B

Population Areas	Oil and Gas Potential ¹	Seismic			Well Pads							Roads			Pipelines			Ancillary Features Acres	TOTAL Dist. Acres	
		Seismic Lines (Miles)	Dist. Acres	Avg. Dist./ Mi.	Total Well Pads	Federal Well Pads	Non-federal Well Pads	Avg. Dist. / Pad	Total Pad Dist. Acres	Federal Pad Dist. Acres	Non-federal Pad Dist. Acres	Roads Miles	Dist. Acres	Avg. Mi./ Pad	Avg. Dist/ Mi.	Pipe-lines Miles	Dist. acres			
Hamlin Valley	L	50	60	1.2	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	60
Bald Hills	M, L	75	90	1.2	2	1	1	4	8	4	4	15	90	7.5	6	0	0	0	0	188
Panguitch	L, M	60	72	1.2	1	1	0	4	4	4	0	8	45	7.5	6	0	0	0	0	121
Parker Mtn.	L, H	65	78	1.2	1	1	0	4	4	4	0	8	48	8.0	6	0	0	0	0	130
Emery	H, M, L	75	90	1.2	35	31	4	4	140	124	16	40	240	1.1	6	5	30	20	520	
Sheeprocks	M, L	100	120	1.2	2	1	1	4	8	4	4	15	90	7.5	6	0	0	0	0	218
Strawberry	M, H	120	150	1.2	57	2	55	4	228	8	220	75	450	1.3	6	68	408	18	1,254	
Carbon	M, H, L	300	360	1.2	607	411	196	4	2,428	1,644	784	460	2,760	0.8	6	291	1,746	184	7,478	
Uinta	H, M, L	300	360	1.2	530	418	112	6	3,180	2,508	672	330	1,980	0.6	6	795	4,770	160	10,450	
Rich	H, M, L	75	90	1.2	25	9	16	4	100	36	64	57	342	2.3	6	36	85	14	631	
Box Elder	L	70	84	1.2	0	0	0	4	0	0	0	0	0	0.0	0	0	0	0	0	84
WY Uinta	M,H	10	12	1.2	4	3	1	4	16	12	4	10	6	5.0	6	5	30	8	126	
STATEWIDE TOTAL		1,300	1,566		1,264	878	386		6,116	4,348	1,768	1,018	6,105			1,200	7,069	404	21,260	

¹ L=low, M=moderate, H=high

Table R.5
Estimated Surface Disturbance: Alternative C

Population Areas	Oil and Gas Potential ¹	Seismic			Well Pads							Roads			Pipelines		Ancillary Features Acres	TOTAL Dist. Acres		
		Seismic Lines (Miles)	Dist. Acres	Avg. Dist./ Mi.	Total Well Pads	Federal Well Pads	Non-federal Well Pads	Avg. Dist. / Pad	Total Pad Dist. Acres	Federal Pad Dist. Acres	Non-federal Pad Dist. Acres	Roads Miles	Dist. Acres	Avg. Mi./ Pad	Avg. Dist / Mi.	Pipe-lines Miles			Dist. acres	
Hamlin Valley	L	50	60	1.2	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	60
Bald Hills	M, L	75	90	1.2	2	1	1	4	8	4	4	15	90	7.5	6	0	0	0	0	188
Panguitch	L, M	60	72	1.2	1	1	0	4	4	4	0	8	45	7.5	6	0	0	0	0	121
Parker Mtn.	L, H	65	78	1.2	1	1	0	4	4	4	0	8	48	8.0	6	0	0	0	0	130
Emery	H, M, L	75	90	1.2	26	23	3	4	104	92	12	30	180	1.2	6	4	23	15	412	
Sheeprocks	M, L	100	120	1.2	2	1	1	4	8	4	4	15	90	7.5	6	0	0	0	218	
Strawberry	M, H	120	150	1.2	55	2	53	4	215	7	208	70	420	1.3	6	65	390	16	1,191	
Carbon	M, H, L	300	360	1.2	575	389	186	4	2,300	1,556	744	453	2,718	0.8	6	275	1,650	174	7,202	
Uinta	H, M, L	300	360	1.2	521	411	105	6	3,126	2,466	630	315	1,890	0.6	6	765	4,590	147	10,113	
Rich	H, M, L	75	90	1.2	25	9	16	4	100	36	64	57	343	2.3	6	36	85	14	632	
Box Elder	L	70	84	1.2	0	0	0	4	0	0	0	0	0	0.0	0	0	0	0	84	
WY Uinta	M,H	10	12	1.2	4	3	1	4	16	12	4	10	60	5.0	6	5	30	7	125	
STATEWIDE TOTAL		1,300	1,566		1,212	841	366		5,885	4,185	1,670	981	5,884			1,150	6,768	373	20,476	

¹ L=low, M=moderate, H=high

Table R.6
Estimated Surface Disturbance: Alternative D

Population Areas	Oil and Gas Potential ¹	Seismic			Well Pads							Roads			Pipelines			Ancillary Features Acres	TOTAL Dist. Acres
		Seismic Lines (Miles)	Dist. Acres	Avg. Dist./Mi.	Total Well Pads	Federal Well Pads	Non-federal Well Pads	Avg. Dist./Pad	Total Pad Dist. Acres	Federal Pad Dist. Acres	Non-federal Pad Dist. Acres	Roads Miles	Dist. Acres	Avg. Mi./Pad	Avg. Dist./Mi.	Pipe-lines Miles	Dist. acres		
Hamlin Valley	L	50	60	1.2	1	1	0	4	4	4	0	10	60	10.0	6	0	0	0	124
Bald Hills	M, L	75	90	1.2	2	1	1	4	8	4	4	15	90	7.5	6	0	0	0	188
Panguitch	L, M	60	72	1.2	2	2	0	4	8	8	0	15	90	7.5	6	0	0	0	170
Parker Mtn.	L, H	65	78	1.2	1	1	0	4	4	4	0	8	48	8.0	6	0	0	0	130
Emery	H, M, L	75	90	1.2	35	31	4	4	140	124	16	40	240	1.1	6	5	30	20	520
Sheeprocks	M, L	100	120	1.2	2	1	1	4	8	4	4	15	90	7.5	6	0	0	0	218
Strawberry	M, H	120	150	1.2	60	2	58	4	240	8	232	80	480	1.3	6	75	450	20	1,340
Carbon	M, H, L	300	360	1.2	653	442	211	4	2,612	1,768	844	514	3,086	0.8	6	313	1,894	198	8,150
Uinta	H, M, L	300	360	1.2	565	446	119	6	3,390	2,676	714	379	2,273	0.7	6	748	4,531	165	10,719
Rich	H, M, L	75	90	1.2	33	12	21	4	132	48	84	75	451	2.3	6	47	118	19	810
Box Elder	L	70	84	1.2	0	0	0	4	0	0	0	0	0	0.0	0	0	0	0	84
WY Uinta	M,H	10	12	1.2	4	3	1	4	16	12	4	10	60	5.0	6	5	30	10	128
STATEWIDE TOTAL		1,300	1,566		1,358	942	416		6,562	4,660	1,902	1,161	6,968			1,193	7,053	432	22,581

¹ L=low, M=moderate, H=high

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