# A Community Approach to Oil and Gas Development: Creating a Partnership for the Future

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# Conceptual Development Scenarios for Oil and Gas Development in Sweet Grass County, Montana

## Foreword

This report was prepared for Cottonwood Resource Council by Kuipers & Associates, LLC as a planning aid for mineral rights owners, local officials, and citizens who will be impacted by oil and gas development in Sweet Grass County. Cottonwood Resource Council is a grassroots conservation group that works to safeguard Sweet Grass County's high quality of life for future generations. Kuipers and Associates is an engineering firm based in Butte, Montana. Should the companies decide to pursue large-scale production in the Crazy Mountain Basin, it is important for residents to be well-informed.

The report develops three conceptual scenarios that are intended to illustrate the potential impacts Sweet Grass County residents could encounter in the case of large-scale, uncontrolled, development of oil and gas resources. These scenarios differ in the number of wells being drilled, fracked, and put into production in a given period of time. They also differ in how many Best Management Practices are applied to the development of the oil/gas field.

Cottonwood Resource Council has prepared the introduction, conclusions and call to action sections of this report, while Kuipers & Associates developed the three conceptual scenarios presented. Information used in the scenarios, such as impacts to roads, water and labor needs, is based on referenced impacts and infrastructure needs from ongoing oil and gas developments throughout the United States.

The scenarios are followed by a document entitled "Applicable Laws & Best Management Practices for Oil and Gas Exploration, Development and Well Closure." This report was also prepared with help from Kuipers and Associates.

# Introduction

Natural gas and oil deposits beneath the United States, and in particular Montana, have become an important commodity as energy demands increase, and dependence on foreign sources becomes less desirable. These factors have led to the exploration of multiple oil and gas plays throughout the nation.

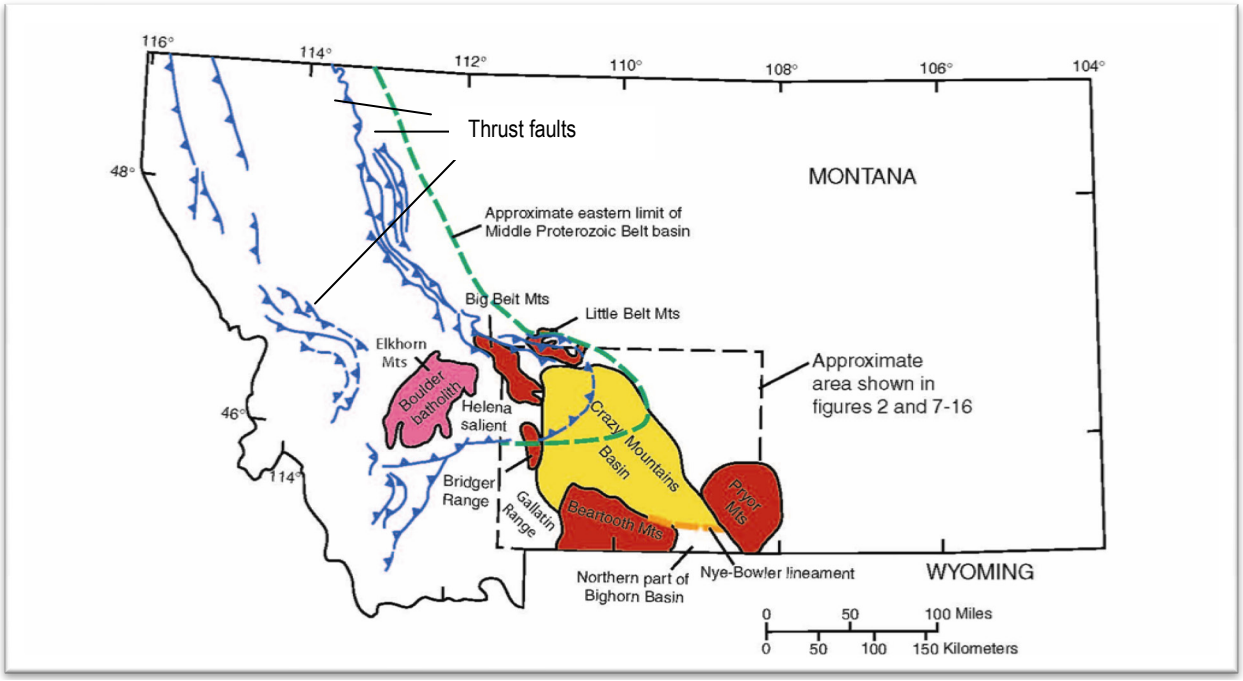



**Figure 1:** Location of Crazy Mountains Basin.

Energy companies have begun oil and gas exploration in the Crazy Mountains Basin, including Sweet Grass County and surrounding counties (Johnson et al. 2005). . Although it is unknown exactly if or when the Crazy Mountains Basin will be developed, large-scale oil and gas production may be a significant part of Sweet Grass County's future.

Today, residents enjoy a high quality of life with clean drinking and irrigating water, good pasture, fresh air, small town values, world-class fishing streams, rich hunting grounds, and beautiful views of the Crazy Mountains, while benefiting from tourism dollars.

On the other hand, boomtowns that have experienced rapid oil and gas development report problems with overtaxed roads, police, firefighters, health clinics, schools, and housing, to name a few examples. The supportive networks of neighbors knowing and trusting one another are disrupted by large numbers of out-of-town, and primarily temporary, oil and gas industry workers. Water contamination related to drilling and hydraulic fracturing, and dusty, fume-filled air are growing concerns.

Boomtowns also report being unprepared for the magnitude of the impacts of resource extraction. **Now is the time for Sweet Grass County to plan and prepare for the needs of a possible influx of workers and equipment.**

Oil and gas development brings a potential for economic benefits, but without informed preparation, extraction may damage the natural resources and community infrastructure on which so many of us depend. It is important to engage all members of the community in an informed discussion of likely impacts as oil and gas development has the potential to create conflict. While some may profit greatly, others may suffer the adverse effects of an ill-managed development.

Early action is required to protect the amenities of the county before unplanned and uncoordinated development begins. Possible negative social, environmental and economic impacts from oil and gas development can be minimized by:

- understanding the laws and regulations in place to address impacts from development
- working to implement the relevant best management practices (BMPs) outlined in the accompanying document
- establishing a coordinated effort with participation from all parties affected
- identifying revenue for pre-payment of needed infrastructure upgrades

This report is not intended to stop resource extraction in Sweet Grass County. Rather, its purpose is to provide three conceptual scenarios to illustrate how oil and gas field development might proceed. Each contrasts the speed of field development and economic benefits with the impacts on infrastructure and quality of life. Considering these conceptual scenarios (and others), planners can promote economic development while minimizing the potentially negative social and environmental impacts associated with energy extraction.

Cottonwood Resource Council (CRC) commissioned Kuipers & Associates, LLC to assist in creating these scenarios to examine how oil and gas development in the county may proceed. These scenarios, which begin on page 8, include:

Scenario 1: Uncontrolled "Boom" Development
Scenario 2: Planned Development with Applicable Best Management Practices
Scenario 3: Phased Development with Applicable Best Management Practices

In 2010, CRC conducted a review of registered leases at the Sweet Grass County courthouse. Members found approximately 967 individual leases within the county for oil and gas exploration and development (Figure 2). The conceptual scenarios and figures in this report were created by entering this data into ArcGIS™, and using geospatial data available through the State of Montana to develop them. These scenarios are conceptual and are to be used for informational purposes to aide in the preliminary planning stages. The scenarios illustrate the need for a strong collaborative effort between oil and gas companies, local governments, and the citizens of Sweet Grass County to ensure responsible development of oil and gas in the county with minimal impacts on the community.

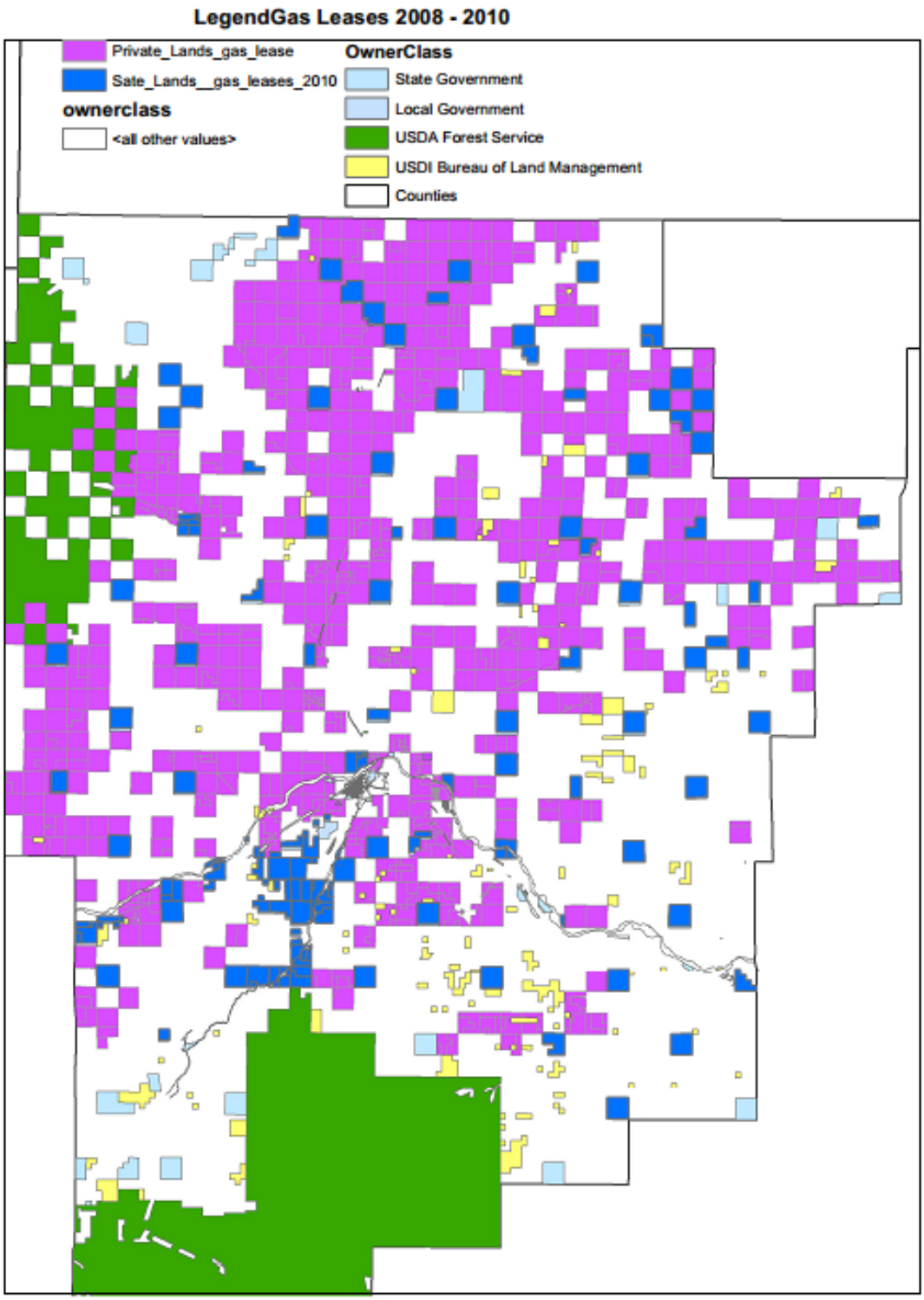



**Figure 2:** Sweet Grass County oil and gas leases.

# Effects Considered

Oil and gas extraction has the potential to cause substantial impacts to the county's transportation systems, water supplies, workforce and social infrastructure. These potential effects are discussed in the following sections, and are analyzed in detail for each of the oil and gas development scenarios.

## *Transportation*

According to a study conducted by the Upper Great Plains Transportation Institute, an average of 2,024 truckloads are needed to fully develop an oil or gas well in the producing counties of North Dakota (Tolliver 2010). The following table shows the number of trucks needed for each task required to develop a well.

**Table 1:** Average number of trucks needed per well (Tolliver 2010).

| Item | Number of Trucks Needed |
|---|---|
| Sand | 80 |
| Water (Fresh) | 400 |
| Water (Waste) | 200 |
| Fracking Tanks | 100 |
| Rig Equipment | 50 |
| Drilling Mud | 50 |
| Chemical | 4 |
| Cement | 15 |
| Pipe | 10 |
| Scoria/Gravel | 80 |
| Fuel Trucks | 7 |
| Fracking/Cement Pump Trucks | 15 |
| Workover Rigs | 1 |
| Total – One Direction | 1,012 |
| **Total Trucks** | **2,024** |

On average, 50 truckloads are required to initially set up the drill rig and equipment, and 600 trucks are needed to haul water for the fracturing process. In addition to the construction of new roads to access the well sites, improvements to existing roads will be needed to accommodate the additional traffic and heavy loads. The increased traffic will contribute to wear and tear on local roads, and repairs will be required more frequently than planned. Without a dedicated revenue source identified as part of oil and gas development, the county and/or state will be required to fund any repairs or upgrades needed for existing roads. A source for revenues to address road upgrades and repairs needs to be agreed upon by the county and the oil and gas companies before development proceeds. This is particularly important since state oil and gas taxes take up to two years to be allocated through the Legislature.

For reference, traffic count data prepared by the Montana Department of Transportation (DOT) for Sweet Grass County is illustrated in Table 4 and Figure 3. The data suggests that several of the roads in the county are relatively uncrowded, and the increased traffic from oil and gas activities should be quite noticeable. Interstate 90 had an average of 7,950 vehicles per day just outside of Big Timber in 2011. US and State Highways in the county averaged 665 vehicles per

day in 2011, while county and local roads had an average of 135 vehicles per day. In addition to areas where traffic is counted by Montana DOT, traffic increases are anticipated for Otter Creek Road, Wormser Loop, Big Timber Canyon and Swamp Creek (please refer to the accompanying BMPs document for mitigations to reduce impacts associated with oil and gas traffic).

## *Water Usage*

On average, a gas well will use 5.3 million gallons of water through the drilling and hydraulic fracturing processes. During the drilling process, water is pumped down to carry rock cuttings to the surface and to cool and lubricate the drill bit. During the hydraulic fracturing or "fracking" process, which uses the majority of the water at a well site, water is pumped into the hole with sand and chemicals at a high pressure to expand and hold fractures in the rock to allow oil or gas to flow into the well. The following table outlines the average water usage per well along with the average depth of wells based on several natural gas plays throughout the nation (Chesapeake 2011).

**Table 2:** Average water use requirements per well for US Natural Gas Deposits (Chesapeake, 2011).

| Natural Gas Deposit | Average Depth of Well (ft) | Average Volume of Water Used for Drilling (gallons per well) | Average Volume of Water Used for Fracturing (gallons per well) |
|---|---|---|---|
| **Barnett Shale (TX)** | 7,200 | 250,000 | 3,800,000 |
| **Eagle Ford Shale (TX)** | 8,000 | 125,000 | 6,000,000 |
| **Haynesville Shale (AR, LA, TX)** | 11,000 | 600,000 | 5,000,000 |
| **Marcellus Shale** (MD, NY, OH, PA,WV) | 5,300 | 100,000 | 5,500,000 |
| **Average** | **7,875** | **268,750** | **5,075,000** |

A few exploratory oil and gas wells have been drilled in Sweet Grass and Park Counties. Details of these exploratory drill holes are provided in Table 3.

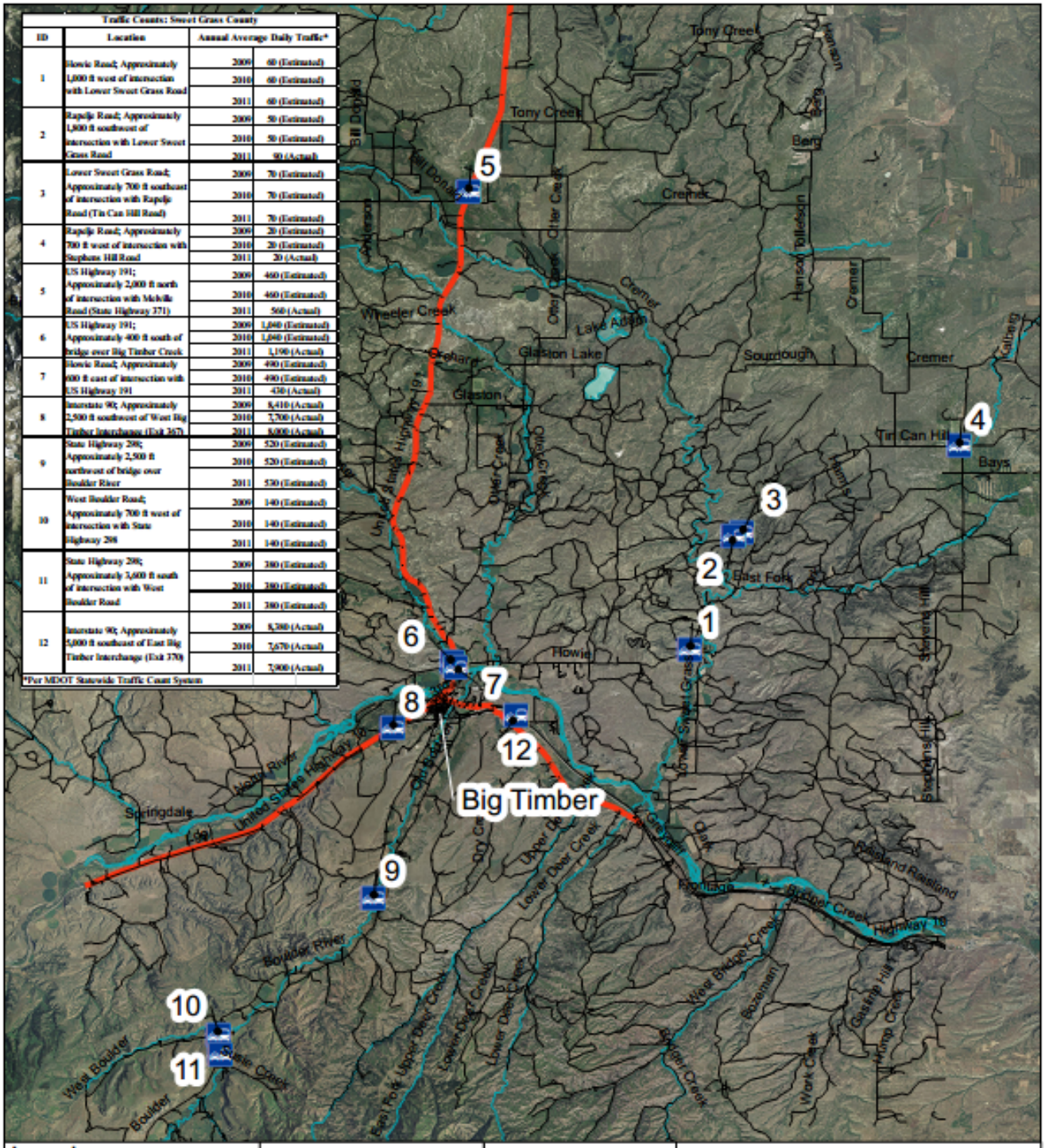
**Table 3**: Exploratory wells drilled in Sweet Grass and Park Counties.

| Company | Type | Formation | Completion date | Depth |
|---|---|---|---|---|
| Bill Barrett Corporation | Oil | Cody Shale | 11/24/2007 | 12441 |
| Bill Barrett Corporation | Gas | Cody Shale | 1/24/2008 | 11005 |
| Bill Barrett Corporation | Gas | Cody Shale | 9/29/2008 | 5439 |
| Devon Energy | Gas | Cody Shale | 12/18/2008 | 8888 |
| Bill Barrett Corporation | Oil | Cody Shale | 6/24/2009 | 6800 |
| Bayswater Exploration and Production | Gas | Lakota, Big Elk Sandstone | 1/8/2010 | 4038 |
| Noble Energy Inc. | Oil | | 2/14/2011 | 4268 |

Water used for fracking is mixed with several chemicals that have the potential to contaminate the surrounding surface and groundwater should the well casing or storage impoundment fail. It is important to ensure best management practices are enacted to properly case the drill hole (typically with cement or steel casings) to prevent fluids from escaping to the surrounding environment.

All captured water must be disposed of properly according to state and federal regulations. Current operational practices to manage the contaminated water include: hauling the water off-site for treatment and disposal, treatment and disposal on site, injecting the water back underground, and agricultural irrigation or evaporation over the reserve pits (please refer to the accompanying BMP document for ideas on how to protect water resources from oil and gas development).

**Figure 3: Traffic Data (PDF)**




| Traffic Counts: Sweet Grass County | | | |
|---|---|---|---|
| ID | Location | Annual Average Daily Traffic* | |
| 1 | Howie Road; Approximately 1,000 ft west of intersection with Lower Sweet Grass Road | 2009 | 60 (Estimated) |
| | | 2010 | 60 (Estimated) |
| | | 2011 | 60 (Estimated) |
| 2 | Rapelje Road; Approximately 1,800 ft southwest of intersection with Lower Sweet Grass Road | 2009 | 50 (Estimated) |
| | | 2010 | 50 (Estimated) |
| | | 2011 | 90 (Actual) |
| 3 | Lower Sweet Grass Road; Approximately 700 ft southeast of intersection with Rapelje Road (Tin Can Hill Road) | 2009 | 70 (Estimated) |
| | | 2010 | 70 (Estimated) |
| | | 2011 | 70 (Estimated) |
| 4 | Rapelje Road; Approximately 700 ft west of intersection with Stephens Hill Road | 2009 | 20 (Estimated) |
| | | 2010 | 20 (Estimated) |
| | | 2011 | 20 (Actual) |
| 5 | US Highway 191; Approximately 2,000 ft north of intersection with Melville Road (State Highway 371) | 2009 | 460 (Estimated) |
| | | 2010 | 460 (Estimated) |
| | | 2011 | 560 (Actual) |
| 6 | US Highway 191; Approximately 400 ft south of bridge over Big Timber Creek | 2009 | 1,040 (Estimated) |
| | | 2010 | 1,040 (Estimated) |
| | | 2011 | 1,190 (Actual) |
| 7 | Howie Road; Approximately 600 ft east of intersection with US Highway 191 | 2009 | 490 (Estimated) |
| | | 2010 | 490 (Estimated) |
| | | 2011 | 430 (Actual) |
| 8 | Interstate 90; Approximately 2,500 ft southwest of West Big Timber Interchange (Exit 367) | 2009 | 8,410 (Actual) |
| | | 2010 | 7,700 (Actual) |
| | | 2011 | 8,000 (Actual) |
| 9 | State Highway 298; Approximately 2,500 ft northwest of bridge over Boulder River | 2009 | 520 (Estimated) |
| | | 2010 | 520 (Estimated) |
| | | 2011 | 530 (Estimated) |
| 10 | West Boulder Road; Approximately 700 ft west of intersection with State Highway 298 | 2009 | 140 (Estimated) |
| | | 2010 | 140 (Estimated) |
| | | 2011 | 140 (Estimated) |
| 11 | State Highway 298; Approximately 3,600 ft south of intersection with West Boulder Road | 2009 | 380 (Estimated) |
| | | 2010 | 380 (Estimated) |
| | | 2011 | 380 (Estimated) |
| 12 | Interstate 90; Approximately 5,000 ft southeast of East Big Timber Interchange (Exit 370) | 2009 | 8,380 (Actual) |
| | | 2010 | 7,670 (Actual) |
| | | 2011 | 7,900 (Actual) |

*Per MDOT Statewide Traffic Count System

**Legend**

Traffic Count

**ROADCLASS**

- US highway
- State and secondary highway
- Local road or city street
- Arterial road

N

0 1.75 3.5 7

Miles

COTTONWOOD RESOURCE COUNCIL

**Traffic Counts: Sweet Grass County**

| Figure 3 | Scenario Report |
|---|---|
| Date: 9/19/2012 | Cottonwood Resource Council |

Table 4: Potential oil and gas traffic increases at the traffic count sites

| | | 40-Acre Spacing (Scenario 1) 6.5-year development | | | 640-Acre Spacing (Scenarios 2 and 3) 10-year development | | | |
|---|---|---|---|---|---|---|---|---|
| ID | Location | Wells Serviced by Road* | Average Truckloads per day | Total Truckloads on Road | Well Pads Serviced by Road** | Wells Serviced by Road | Average Truckloads per day | Total Truckloads on Road |
| 1 | Howie Road; Approximately 1,000 ft west of intersection with Lower Sweet Grass Road | 336 | 287 | 680,064 | 7 | 21 | 12 | 42,504 |
| 2 | Rapelje Road; Approximately 1,800 ft southwest of intersection with Lower Sweet Grass Road | 1,584 | 1,351 | 3,206,016 | 33 | 99 | 55 | 200,376 |
| 3 | Lower Sweet Grass Road; Approximately 700 ft southeast of intersection with Rapelje Road (Tin Can Hill Road) | 432 | 369 | 874,368 | 9 | 27 | 15 | 54,648 |
| 4 | Rapelje Road; Approximately 700 ft west of intersection with Stephens Hill Road | 672 | 573 | 1,360,128 | 14 | 42 | 23 | 85,008 |
| 5 | US Highway 191; Approximately 2,000 ft north of intersection with Melville Road (State Highway 371) | 2,592 | 2,211 | 5,246,208 | 54 | 162 | 90 | 327,888 |
| 6 | US Highway 191; Approximately 400 ft south of bridge over Big Timber Creek | 8,496 | 7,248 | 17,195,904 | 177 | 531 | 294 | 1,074,744 |
| 7 | Howie Road; Approximately 600 ft east of intersection with US Highway 191 | 3,648 | 3,112 | 7,383,552 | 76 | 228 | 126 | 461,472 |
| 8 | Interstate 90; Approximately 2,500 ft southwest of West Big Timber Interchange (Exit 367) | 2,208 | 1,884 | 4,468,992 | 46 | 138 | 77 | 279,312 |
| 9 | State Highway 298; Approximately 2,500 ft northwest of bridge over Boulder River | 192 | 164 | 388,608 | 4 | 12 | 7 | 24,288 |
| 10 | West Boulder Road; Approximately 700 ft west of intersection with State Highway 298 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | State Highway 298; Approximately 3,600 ft south of intersection with West Boulder Road | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | Interstate 90; Approximately 5,000 ft southeast of East Big Timber Interchange (Exit 370) | 912 | 778 | 1,845,888 | 19 | 57 | 32 | 115,368 |

*Approximate, assumes all travel is from Big Timber, based on GIS

**Approximate, assumes three wells per well pad and all travel is from Big Timber, based on GIS

## *Workforce and Social Impacts*

The development of a single oil or gas well requires expertise and support from a wide variety of occupations. Employees and contractors working to bring an oil and gas well into production may include truck drivers, oil rig laborers, geologists, engineers, and many more. Development of an oil or gas field will bring an influx of jobs that will further strain the existing infrastructure and services within a county. If proper BMPs are used to control the pace of development, these impacts can be mitigated. According to a study by the Marcellus Shale Education and Training Center, each natural gas well in the Marcellus Shale region takes 420 people from 150 different occupations to bring a well into production (Brundage et al. 2011). A breakdown of occupations required to complete a well is shown in Figure 4.

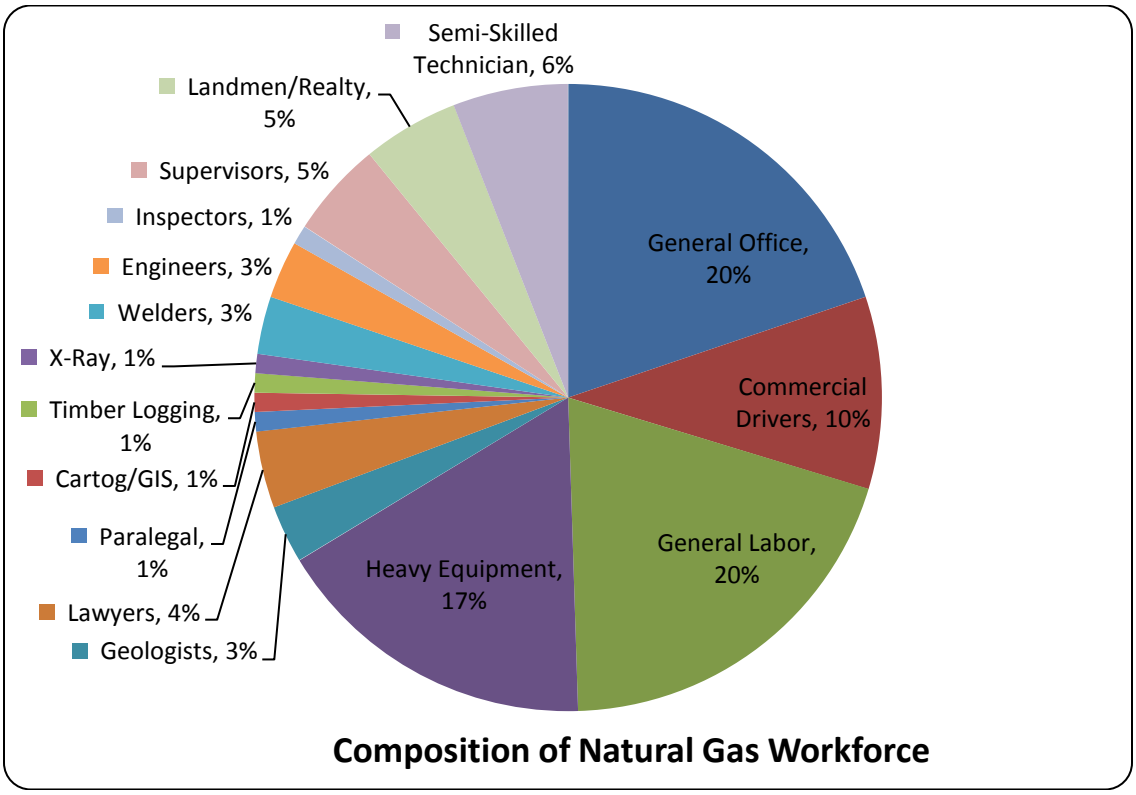



**Figure 4:** Composition of occupations needed for a natural gas well (Brundage et al. 2011).

While many of the specialty jobs needed to develop a well will probably come from outside the county, some general labor and office jobs will be sourced locally. Oil and gas jobs are typically well-paying, which may make it difficult for existing local businesses to retain employees. The longevity of oil and gas jobs will vary considerably depending on the type of position, the company's strategy for an area, and the actual amount of oil and gas reserves.

The average rig will drill 12 wells in a given year (Brundage et al. 2011), taking about 30 days to complete a well. This includes laying the pipeline connecting the well to a network which can be

done concurrently with drilling. Drilling operations typically run continuously 24 hours a day until the well is completed. Fracking, which usually takes place during daylight hours, adds an average of four days resulting in a total of 34 days to bring a well into production (Chesapeake 2011). The time to complete a well may vary significantly depending on the location, depth of well, ground conditions, operational upsets and other factors. Only a few operations and maintenance tasks are required once a well is in production, therefore the workforce required after the installation of a well is insignificant.

Taking all these and other factors into consideration, the study found that it takes approximately 13.1 full-time positions a year to complete one gas well in the Marcellus Shale region (Brundage et al. 2011). Since little is known about the basin present beneath Sweet Grass County, the average development conditions for the Marcellus Shale Play will be applied to the conceptual scenarios.

The composition of the workforce for Sweet Grass County is shown in Figure 5 (MT Department of Labor and Industry, 2012).

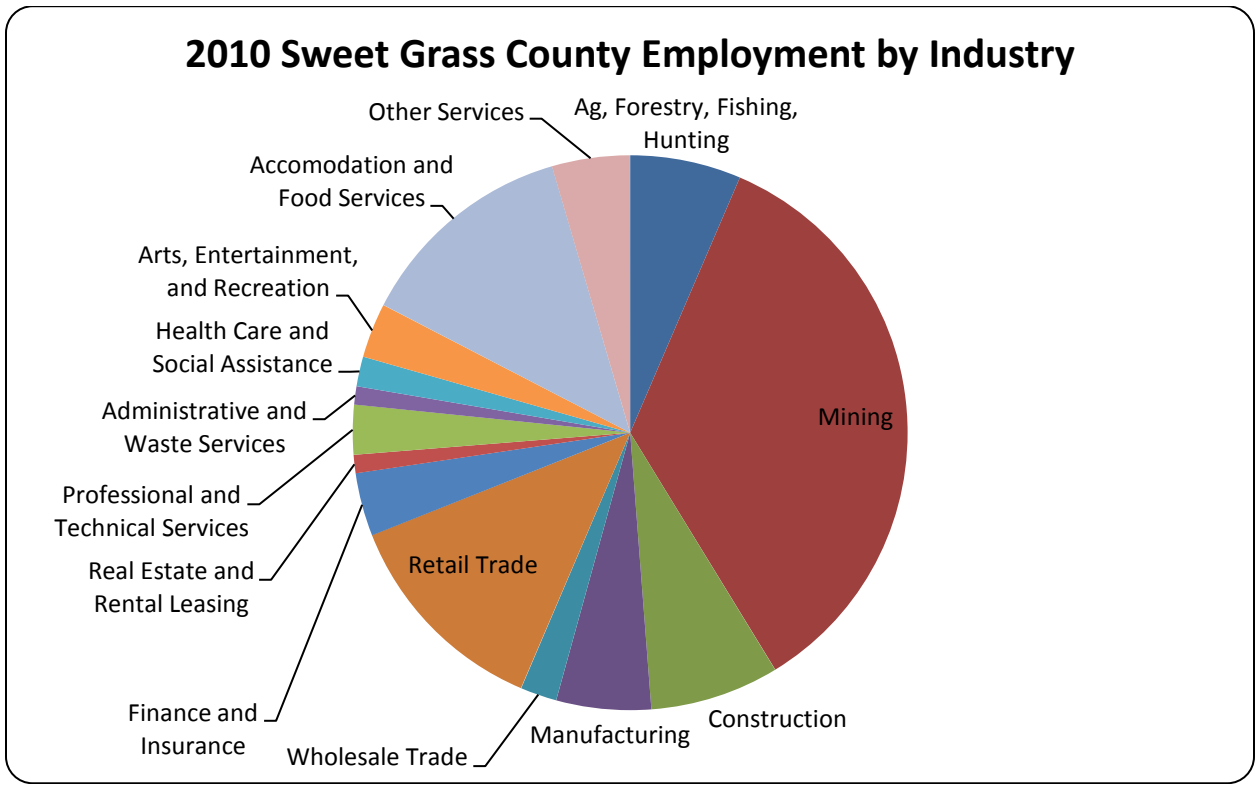



**Figure 5:** 2010 Sweet Grass County Employment by Industry.

By comparing the charts, it is clear that many of the jobs needed for development cannot be supplied by the existing workforce in Sweet Grass County. Typically a majority of workers is

migrant because of the large number of jobs needed to develop the wells over a short period of time. The county's infrastructure may be pushed to the limits by this rapid influx. Phasing development over several years may help to alleviate many of the impacts associated with rapid population increases.

Because there are a finite amount of drilling rigs and personnel available to operate them, the number of wells that can be drilled in a given area is also limited. In 2010, Pennsylvania counties in the active portions of the Marcellus Shale had an average of 83 wells drilled per year, with a maximum of 355 wells (Brundage et al. 2011). That same report projected that approximately 900 wells could reasonably be drilled per year in producing counties in southwest Pennsylvania. The North Dakota Department of Mineral Resources, Oil and Gas Division, recently estimated that 1,100 to 2,700 wells could be drilled per year in Western North Dakota (primarily McKenzie County) in the Bakken and Three Forks oil formations (Ruggles 2011). This report assumes development of a maximum of 1,100 wells drilled in Sweet Grass County per year, with 100 wells drilled per year assumed as the typical rate, in the conceptual scenarios.

# Development Scenarios

The following three conceptual scenarios were created to illustrate potential oil and gas development in Sweet Grass County, Montana, taking into account the impacts described above (transportation, water use, workforce, and social impacts), as well as existing infrastructure, natural resources and environmental concerns. The private properties with current oil and gas leases were used to determine the quantity and possible location of wells that could conceivably be constructed in the county using the assumptions of each scenario.

## *Scenario 1: Uncontrolled "Boom" Development*

This scenario assumes unplanned, unchecked development with 40-acre well spacing, which maximizes economic returns without addressing environmental or socio-economic concerns. A maximum of 7,200 wells could be drilled over 6 ½ years under this scenario.

The unplanned development scenario assumes the maximum number of wells are constructed on the leased properties, without taking existing infrastructure or environmental impacts into consideration when determining well locations. The following assumptions were used to develop the map for this scenario:

1. Well depths for this scenario are assumed to be less than 6,000 feet. At these depths, the spacing between wells is most commonly 40 acres, according to the Montana Board of Oil and Gas Conservation rules and regulations (MBOGC 2011). For comparison, an example of 40-acre spacing units from the Jonah Field in Wyoming is shown in Figure 6;
2. Using the 40-acre spacing, the maximum number of wells are placed on each privately-leased property. This assumes that a well is drilled in every quarter-quarter section;
3. The maximum number of 1,100 wells are drilled per year;
4. Oil and gas wells are placed without attention paid to location of existing infrastructure, wetlands, surface water resources or vegetation.
5. One well is drilled per well pad[1].
6. Planning efforts were not made to drill multi-well pads, resulting in maximum land disturbances and infrastructure development as illustrated in Figure 7. This results in the maximum number of wells placed on each leased property, with a total of 7,200 wells drilled in the county for scenario one.

Assuming that 7,200 wells are drilled in Sweet Grass County for the first conceptual scenario, and the maximum 1,100 wells are drilled per year, it would take just over six and a half years to complete all the wells. Assuming that development requires 13.1 full-time positions per year to complete a well, approximately 14,400 positions a year would be needed under this scenario.

<u>Over the six and a half year development period, approximately 38.5 billion gallons of water would be used to drill and frack the wells.</u> Water for well development may be sourced from surface waters in the vicinity of the well, extracted from underground aquifers, or pumped or

[1] Technologic advances make it feasible for multiple wells to be drilled on a single well pad through the use of directional drilling. This technique decreases the amount of surface impacts as multiple gas pockets can be reached from a single location.

trucked to the site when water is unavailable in a particular area. Should gas development require the use of fracking fluids, water resources have the potential to be contaminated. Proper treatment and disposal practices must be required to ensure all water is handled according to best management practices so impacts are kept to a minimum. The county may not have adequate water resources to support oil and gas operations. These water resources may become exhausted during development, which could lead to irreversible environmental impacts. Water recycling should be strongly considered to reduce the overall quantity of water used and the truck traffic needed to haul the water.

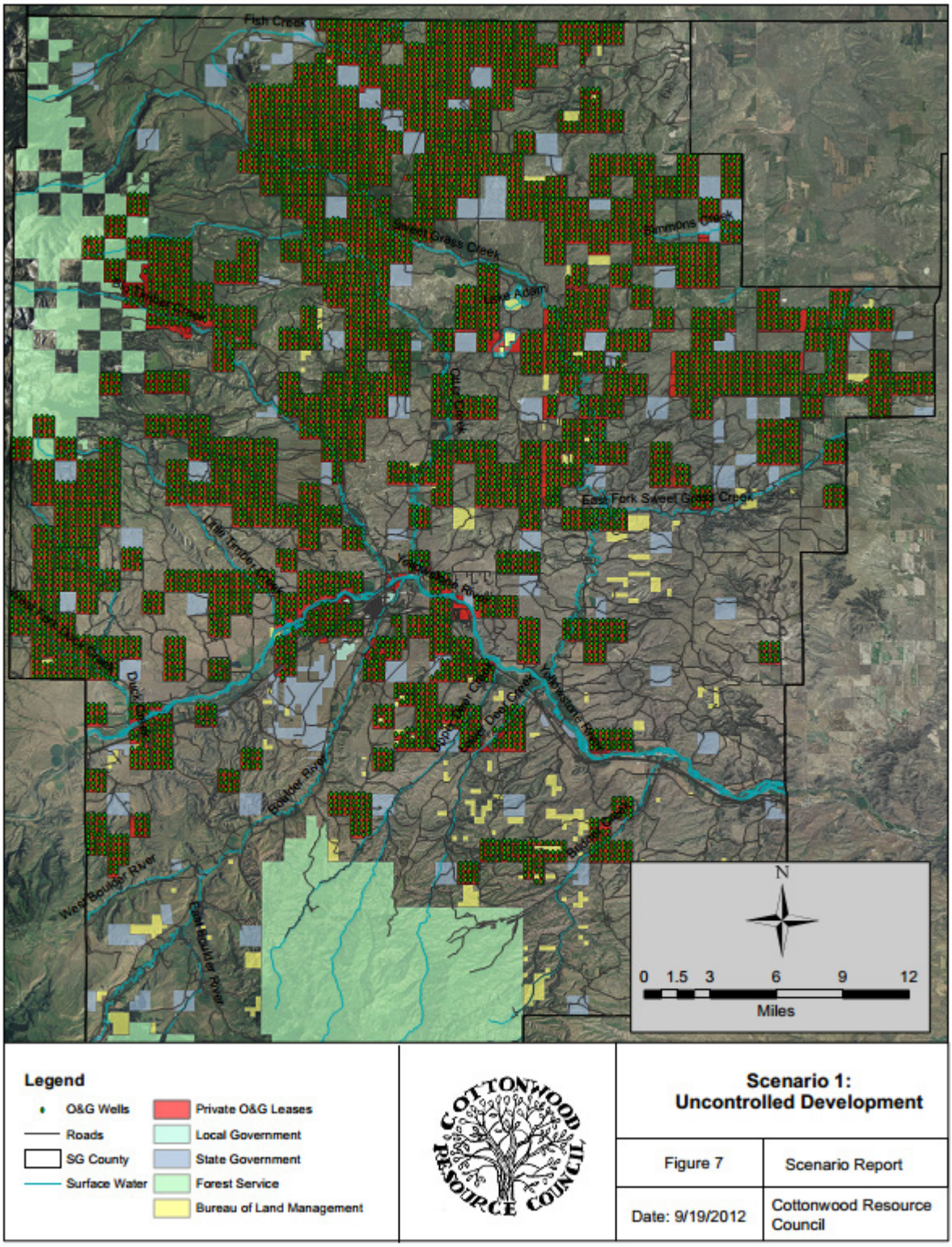
Drilling 7,200 wells within the county would require over 14.5 million truckloads (2.2 million a year) traversing local roads over the development period. Dust, noise and safety mitigations would need to be developed and required to reduce the impacts associated with the increase in trucks on county roads, as described in the accompanying best management practices report. The primary roads in the county (Interstate 90, Highway 191 and 298) are designed to support larger-sized loads and would most likely be able to handle the additional traffic from oil and gas tractor-trailers; however, road maintenance and improvements would be needed more frequently due to the larger loads and increased traffic. Secondary and tertiary roads in Sweet Grass County would most likely require major improvements in order to support the increase in tractor-trailer loads and traffic. Multiple truckloads may need to use remote, unfrequented roads that are unable to support frequent tractor-trailer cargos. Many of these roads would need to be re-built or retrofitted in order to handle the increased traffic.

Under this scenario the natural gas reserves within the county would be depleted over the shortest timeframe when compared to the other conceptual scenarios presented. This means that royalties paid to the owner of the mineral rights would be substantial in the early years of development, but would reduce more rapidly as reserves become depleted. It is not certain how long the gas field would last but the typical well in the Bakken formation remains productive for approximately 29 years (Cashman 2012).

Strong consideration must be paid to the boom and bust nature of oil and gas development. Despite the job and economic growth potential for Sweet Grass County, unplanned, rapid development could lead to detrimental impacts to the socio-economic and environmental aspects of the county that residents have come to depend on. The large influx of workers coming to the county would most likely exceed the existing housing capacity, which could lead to the development of unorganized “man-camps.” Education, water and sewer services, emergency, law enforcement and other public services provided by the county would require expansion in order to deal with the rapid increase in population. Typically tax revenues from gas development are not available in the first two years to address infrastructure needs. The county and companies should work together to develop a plan of action to mitigate these impacts prior to oil and gas development to ensure that infrastructure issues are addressed before development begins, and do not become a financial burden for Sweet Grass County residents.

**Figure 6:** Ten-acre spacing units for the Pinedale field in Wyoming (Image courtesy of Skytruth)

**Figure 7:** GIS Scenario 1



## *Scenario 2: Planned Development with Applicable Best Management Practices*

This conceptual scenario assumes oil and gas development in the county using applicable BMPs and practical rules that could be developed by local government to minimize socio-economic, economic and environmental impacts associated with oil and gas development. For scenario two, multi-well pad construction on 640-acre spacing is assumed. Under this scenario 984 wells are drilled over a ten-year period.

The following assumptions were used to develop this scenario:

1. Well spacing is assumed at 640 acres to help minimize impacts to land, water and other resources within the county. Increasing the spacing of well units will decrease the amount of well pads required on a particular field, therefore decreasing surface disturbances and possibly reducing the effects drilling may have on natural resources in the area. The 640-acre unit for well development is based upon Montana law that has established standard spacing units for oil and gas wells. MBOGC can adjust the size and spacing of oil and gas wells in an established field after official notices and hearings are carried out.
2. Wells are not placed within 1,000 feet of surface water resources or wetlands.
3. Wells are placed near existing roads/transportation systems when possible.
4. On average 100 wells are drilled per year.
5. Three (3) wells are drilled per pad through the use of directional drilling. This technique decreases the amount of surface impacts as multiple reservoirs can be reached from a single location.

In 2010, 77% of all wells drilled in the Marcellus shale play were on multi-well pads, and since 2006, the overall well-to-pad average for all Marcellus wells was 2.11 (Ladlee 2011). This number continues to increase as more wells are placed on new pad developments and on existing pads with a single well. Considering this increasing trend in multi-well pad developments, it is assumed that three wells could reasonably be drilled per pad. It is recommended that the use of multi-well pads be employed throughout the county as these pads can reduce surface disturbances, eliminate the need for additional roads, reduce truck traffic (the drill rig only has to move about 20 feet on the pad to start drilling the next hole), give landowners more flexibility on where to place the wells and roads on their property, and reduce the number of storage tanks and separators needed by consolidating operations and maximizing the facilities constructed on one pad.

Using these assumptions, a total of 328 multi-well pads could theoretically be constructed in the county with a total of 984 wells drilled for scenario 2, as illustrated in Figure 8.

Assuming that 984 wells are drilled in the county, and 100 wells are drilled per year, it would take just under ten years to complete all the wells in this scenario. Considering it takes 13.1 full-time positions per year to install a well, about 1,310 positions would be required each year for ten years to complete all wells.

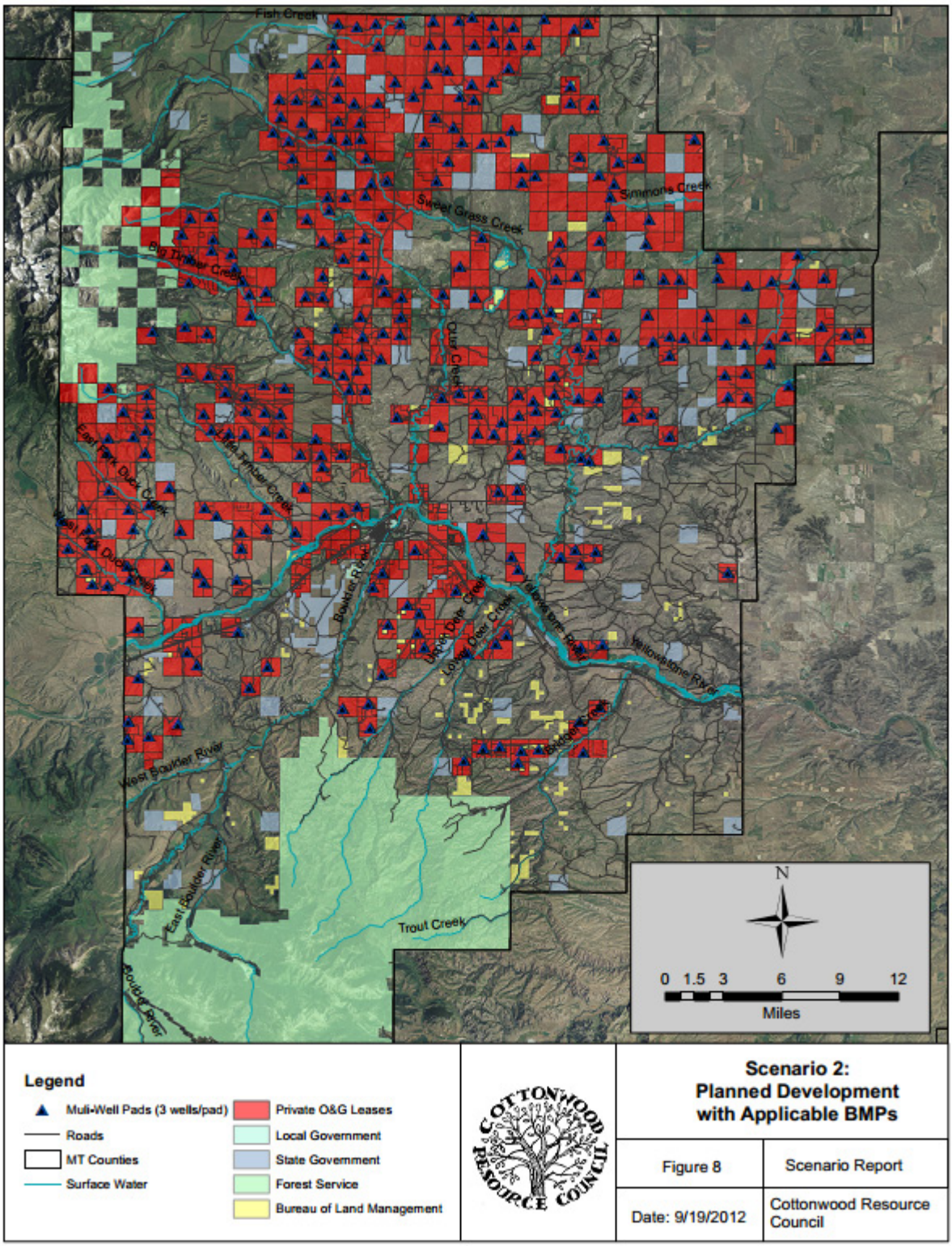
Over the ten-year development period, about 5.3 billion gallons of water would be needed to drill and frack the wells. This water would need to be treated and handled in accordance with BMPs to minimize the impacts to the surrounding environment.

Drilling 984 wells would require approximately 2 million truckloads traveling on county roads over the development period. Improvements would be required on existing transportation systems to handle the additional loads. Dust, noise and safety mitigations would need to be developed to minimize impacts as recommended in the accompanying BMP report.

Under this scenario, the natural gas reserves within the county would be sustained over a greater period of time when compared to unplanned, rapid development. As there would be fewer wells extracting gas from the reserves, the life-span of the wells would increase, and royalties would be paid over a greater amount of time. Conserving the reserves within the county may be a good investment if the nation's energy focus remains on oil and natural gas and demand continues to increase in the future.

With 984 wells drilled throughout the county, resources in Sweet Grass County would still be impacted due to this development. Appropriate BMPs must be required to ensure these social, economic and environmental impacts are minimized. The creation of 1,310 jobs per year would provide an economic stimulus within the county, but preparations must be made in order to handle the influx of workers and their families entering the county. Again, education, water/sewer, emergency, law enforcement, and other public services provided by the county would need to be expanded in order to deal with the increases in population.

**Figure 8:** GIS Scenario 2



### *Scenario 3: Phased Development with Applicable Best Management Practices*

This scenario uses applicable BMPs with development beginning closest to I-90 and proceeding outward in three phases over a ten-year period. It assumes 640-acre spacing and includes multiple wells per drill pad. A total of 984 wells would be drilled under this scenario.

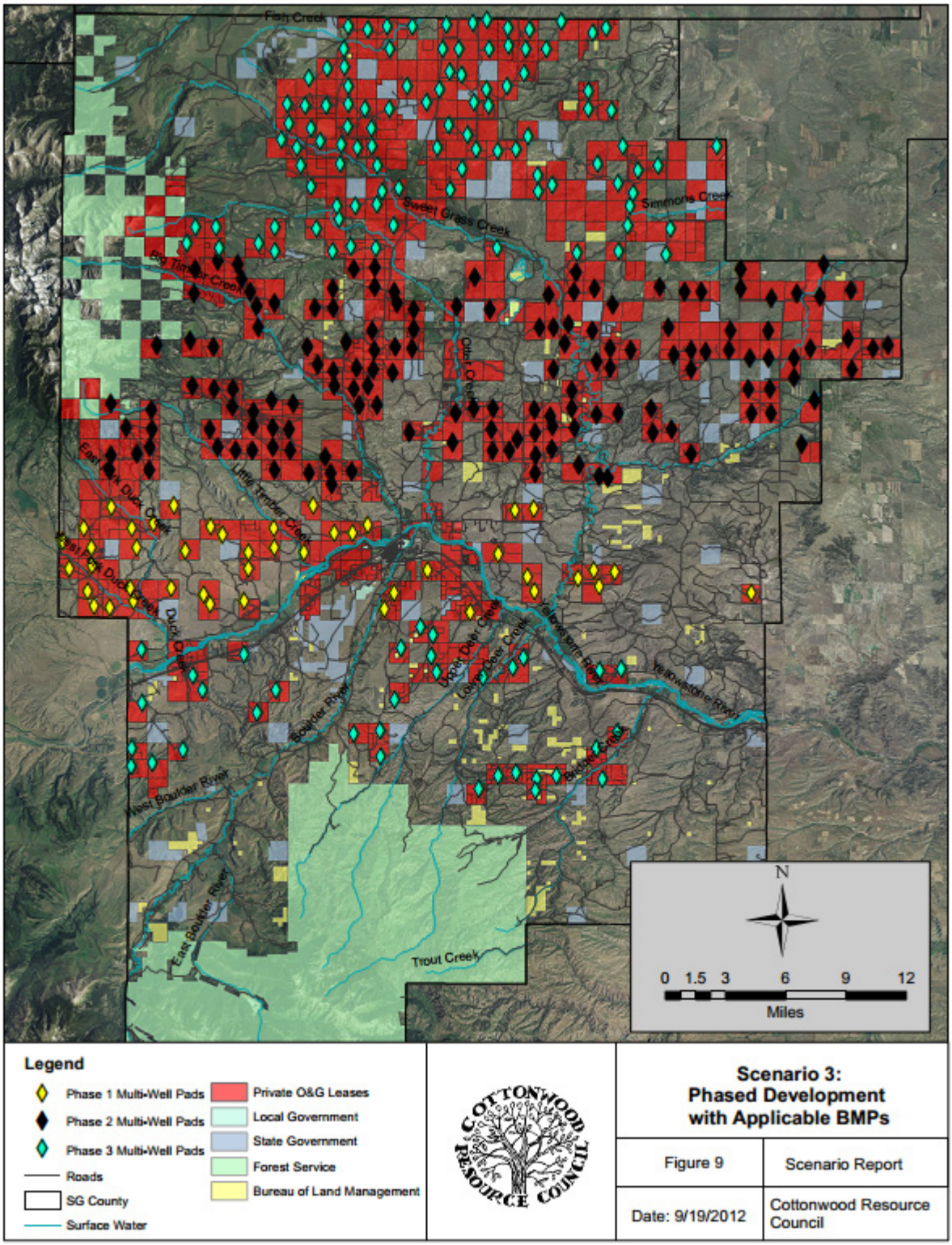
This scenario assumes that, through coordination between the oil and gas companies and the local government, oil and gas development would focus on one strategic area by constructing the wells and necessary infrastructure before expanding out to the next development area.

For the purposes of this report, the first phase focuses on the areas of development closest to the town of Big Timber and Interstate 90. The development companies may choose to phase in development from a different starting point, however phased development is recommended to minimize impacts associated with oil and gas development. It is assumed that all natural gas extracted from the county would connect to a network within the Interstate corridor to be transported out for further refining and distribution. The first phase would establish the necessary infrastructure to connect to this pipeline and eventually handle all gas flows throughout the county. This phase also includes the initial drilling of wells in the development areas closest to the Interstate corridor. The second and third phases each extend the drilling area 12 miles north until the county boundary is reached as shown in Figure 9. The third phase also includes the completion of wells further south of Big Timber. It is assumed that the wells further south will be developed last as the existing leases are more spread out, and the rougher topography may inhibit development. The following assumptions are used to develop this scenario:

1. Spacing of wells in this scenario is assumed to be 640 acres to help limit impacts to land, water and other resources within the county.
2. Wells are not placed within 1,000 feet of surface water resources or wetlands.
3. Wells are placed on or near existing roads/transportation systems.
4. One hundred (100) wells are drilled in the county per year.
5. Three (3) wells are drilled per well pad. The use of multi-well pads has significant advantages for both oil and gas companies and local landowners. These advantages are discussed in section 3.2, where the use of multi-well pads is recommended for oil and gas development in the county.

Using these assumptions, a total of 328 multi-well pads would be constructed and 984 wells drilled through a phased development scenario as illustrated in Figure 9. Phase 1 would result in development of 45 pads and 135 wells, with 148 pads and 444 wells in the second phase, and an additional 135 pads and 405 wells in the third phase of development. The first phase contains a limited amount of drilling as the primary focus during this phase would be infrastructure development.

**Figure 9:** GIS Scenario 3



Under this scenario, the first phase would take approximately one and a half years to complete, the second phase four and a half years, and the third phase just over four years. This results in a total development period of approximately 10 years. Assuming each well requires 13.1 full-time positions per year, and a constant 100 wells are drilled a year for each phase, an average of 1,310 full-time positions would be required each year. The first phase would most likely require more workers than estimated, as additional laborers would be needed for infrastructure developments throughout the county to support subsequent phases of development.

Over the ten-year development period, about 5.3 billion gallons of water would be required to drill and frack the wells, with 721 million gallons during the first phase, 2.4 billion gallons during the second phase, and 2.2 billion gallons during the third phase.

The first development phase would require nearly 273,000 truckloads while the second and third phases 899,000 and 820,000 truckloads, respectively. This brings a total of approximately 2 million truckloads traveling on county roads over the ten-year development period. Similar to the other scenarios, improvements and more frequent maintenance to existing transportation systems along with mitigations to control dust, noise and safety would need to be developed to minimize impacts.

Under this conceptual scenario, the natural gas reserves within the county would be sustained over a greater period of time when compared to unplanned, rapid development. As there would be fewer wells extracting gas from the reserves, the life-span of the wells would increase, and royalties would be paid over a longer period of time.

The phased development scenario would help manage the pace of development, but would require significant cooperation and coordination between local government and the oil and gas companies. If successfully implemented, the phased method has the potential to bring strong economic growth through organized development while limiting the socio-economic and environmental impacts to the county.

# Summary and Conclusions

Gas and oil exploration has already begun in the Crazy Mountains Basin with the drilling of exploratory wells in Sweet Grass and Park Counties. Sweet Grass County courthouse records show mineral-rights owners have leased over 145,000 acres for mineral extraction. Should drilling proceed on all these lands, life in Sweet Grass County as we know it will change dramatically.

Today's "boomtowns" in Wyoming and North Dakota provide concrete examples of what could happen in Sweet Grass County when large-scale development begins. There will be economic benefits for leasing mineral-rights holders, and increased revenues will fuel the area's economy primarily during the drilling and fracking phases. Along with the relatively short-term increase in economic stimulus (Montanans know about "boom and bust cycles") comes the potential for long-term declines in air and water quality, huge increases in demand for water resources, decreased aquifer levels, degraded roads and bridges, higher pressures on schools, police and fire departments, and a primarily male, transient population that needs temporary housing and leisure time activities.

No one can predict when the oil and gas companies will initiate extensive development in our county, but if the community and local government start preparing now, many of the negative impacts could be mitigated through development of county laws and ordinances, or negotiation of private party lease terms, that require implementation of BMPs and other measures. Citizens both could enjoy the economic benefits and preserve the values that make our rural life here in Sweet Grass County so rewarding.

The following table summarizes the transportation, water and workforce requirements for each of the conceptual scenarios developed by Kuipers & Associates for this report. These scenarios clearly illustrate the potential for a reduction of impacts to our County's resources through a planned, and phased, development of oil and gas resources along with implementation of best management practices.

**Table 5:** Conceptual transportation, water and workforce requirements for each scenario.

| | Well Spacing (acres) | Well Pads Constructed | Wells Drilled per Year | Total Wells Drilled | Development Period (years) | Truck-loads Required | Volume of Water Required (gallons) | Full-Time Positions Required Per Year |
|---|---|---|---|---|---|---|---|---|
| **Scenario 1:** ***Uncontrolled Development*** | 40 | 7,200 | 1,100 | 7,200 | 6 ½ | 14.6 million | 38.5 billion | 14,399 |
| **Scenario 2:** ***Planned Development with Applicable BMPs*** | 640 | 328 | 100 | 984 | 10 | 2.0 million | 5.3 billion | 1,309 |
| **Scenario 3:** ***Phased Development with Applicable BMPs*** | 640 | 328<br>P1: 45<br>P2: 148<br>P3: 135 | 100 | 984<br>P1: 135<br>P2: 444<br>P3: 405 | 10 | 2.0 million | 5.3 billion | 1,309 |

# Citizens and Public Officials Take Action

Now is the time to involve mineral-rights owners, lessors, neighbors, public officials and all of our citizens in a process of discovery and idea-exchange. This set of scenarios and accompanying report highlighting BMPs are designed to facilitate that discussion.

With careful planning now, we can require more accountability and less environmental damage from extraction companies. Our power will come from knowledge, neighborly cooperation, and a united approach.

All members of the community must work together now to:

- Learn the rules and regulations already in place that can help mitigate extraction's negative impacts and protect the lessor.
- Become familiar with the Best Management Practices and make them part of all agreements with extraction companies.
- Consider the Scenarios presented in this report and discuss the strengths and weaknesses of each. Coming together around a phased approach would go a long way toward taking control of our own future.
- Organize and use the power of numbers to negotiate with the industry to maintain the future we want for our children.

The Cottonwood Resource Council is providing Sweet Grass County residents with this report, hoping to stimulate a collaborative and respectful planning process that allows for responsible resource extraction and a minimum of negative impacts.

For more information contact: Cottonwood Resource Council at P.O. Box 1105 Big Timber, MT 59011 or at cottonwoodrc@gmail.com.

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# Applicable Laws & Best Management Practices for Oil and Gas Exploration, Development and Well Closure

## Foreword

There is potential for strong economic growth in Sweet Grass and surrounding counties with the development of the oil and natural gas reserves in the area. A thorough understanding of existing laws, implementation of careful and diligent planning efforts, and coordination between the community and oil and gas companies are all necessary to ensure that the environmental, social and economic impacts associated with oil and natural gas development can be minimized to retain the area's high quality of life.

This guide was prepared by Cottonwood Resource Council in conjunction with Kuipers & Associates. It seeks to provide landowners, lessors, the public and local government officials the tools they need to ensure that gas and oil development is done responsibly and safely.

Included in this guide are *Best Management Practices* (BMPs) from a variety of sources including federal and state agencies, engineering experts and oil and gas companies. BMPs are the tools and specific steps that companies and the community should take to ensure that gas and oil developers are using the safest and most up-to-date technologies to extract the resource and reduce the potentially negative impacts to water, range land soils and grasses, air quality, wildlife, and the community.

Additionally, this guide seeks to help mineral and land owners, familiar with the new technologies reflected in these BMPs, to negotiate optimal *Surface Use Agreements (*SUAs) with oil and gas operators, participate in the permitting process with local governments, and gain the benefits of resource extraction without long-term ill effects on their land and water.

This guide does not seek to give legal advice. Please contact an attorney when negotiating leases, SUAs, and other important, legally-binding documents.

# Introduction

The process of developing a new oil or gas field is extremely complicated and new to many landowners and communities. Most people have never had a producing oil or gas well on their property, let alone multiple wells. This document seeks to help those landowners and everyone in the community understand what laws are in place and recommend ways to supplement them.

In this document we will first review all the applicable state and federal laws and the rights of landowners, as well as the applicable laws for those who do not own their minerals. This section is organized as follows:

## Private Minerals & Split Estate

State Laws:

- Leasing
- Surveying
- Permitting
- Entry onto Private Land
- Development
- Reclamation

Federal Laws:

- Leasing
- Permitting
- Development
- Reclamation

Although these state and federal laws provide some protection for landowners and community members who live near oil and gas operations, these safeguards may not be specific enough to address oil and gas development at the local level. For this reason BMPs are extremely important to ensure responsible gas development.

By definition BMPs are "…measures designed to provide for safe and efficient operations while minimizing undesirable impacts to the environment…" according to *The Gold Book*, published by the Bureau of Land Management (BLM) and US Forest Service (USFS). BMPs are not required by law in almost all cases, but with proper communication with oil and gas companies and the community leaders, an agreement to require some additional safeguards can be reached.

There are many phases in the process of exploring and developing a potential gas field, and within each phase are multiple steps. BMPs for development of each individual well are provided in this document first. These are followed by BMPs for specific resource impacts for field development. BMPs are organized into the following categories:

Well-Specific BMPs:

- Leasing
- Exploration
- Permitting

- Well Development
- Well Closure and Reclamation

BMPs by Resource Impact:
- Field Development for Well Production
- Water Quality and Quantity
- Air Quality
- Noise Impacts
- Visual Impacts
- Social and Economic Impacts
- Pests and Noxious Weeds
- Wetland/Riparian Areas
- Roads and Transportation
- Public Safety Around Gas Infrastructure

In order to coordinate all of the BMPs pertaining to the life of a gas or oil field, development of a Master Drilling and Development Plan is recommended. Ideally, this plan brings the efforts of industry and local communities into a comprehensive design that includes coordinated development strategies, environmental considerations, and social/economic mitigation measures. The BMPs recommended here should be included in the Master Drilling and Development Plan for the geologic area known as the Crazy Mountain Basin, as well as used by individual property owners to address their specific projects.

The Master Drilling and Development Plan should incorporate all the various permits that are applied for throughout the process. This plan would ideally include all companies developing in the Crazy Mountain Basin. Within the plan, those companies should coordinate efforts to increase development and production efficiency while minimizing environmental, social and economic impacts. Development of a Master Plan is not required by law and can only be created if local citizens and/or county government take a proactive approach with companies planning to develop.

The following steps are important to a Master Drilling and Development Plan:
a. Implementing a development strategy which addresses cumulative environmental and economic impacts for the Crazy Mountain Basin.
b. Adopting county road standards for gas development and identifying all county roads needing upgrades and maintenance prior to gas development. Establishing a funding source for upgrading county roads prior to gas development.
c. Designing and planning pipelines of sufficient size to handle future gas development potential.
d. Planning on a watershed basis. Watershed planning in the oil and gas development context is an emerging practice that involves coordinating with other companies, surface owners and permitting agencies within and potentially downstream of the watershed. Plans typically entail baseline monitoring and an assessment of water quality, water quantity, water rights, and downstream landowners' concerns.
e. Conducting baseline monitoring studies for water quality, air quality and noise levels prior to oil and gas development.

f. Developing steps to address public safety through participation with local emergency preparedness committees.
g. Adopting a phased-in development plan that minimizes social, economic and environmental impacts to the community.

With all of these recommendations it is important to note that much of this will only happen with an active and informed community. Sweet Grass County and surrounding counties need to work together to make these ideas a reality.

# Current Laws and Regulations

When it comes to oil and gas development most people know very little about the process, their mineral ownership, and all the potential impacts that come with the changing landscape. A thorough understanding of your personal situation, your neighbor's situation, and all the laws that pertain to you will result in quality development for the whole community.

## Private Minerals

Some landowners are lucky enough to own both their land and the majority (51% or more) of the minerals underneath. However, if oil or gas development comes to the area, everyone needs to be prepared.

When the landman (an oil and gas company representative) comes to your door, it can be overwhelming and surprising when he offers you a document along with a signing bonus. But it should be clear that the main documents that direct the development of oil and gas in an area are the lease and the SUA. These documents, if poorly negotiated, can adversely impact the land, water, and air of your and your neighbor's properties. When considering leasing minerals a number of precautions should be followed.

1. Don't sign on the first offer!
2. Talk to your neighbor.
3. Hire a lawyer who is experienced in oil and gas leases.
4. Know what state and federal laws apply and what provisions you need to bolster with a good lease.
5. Make sure to include a SUA provision in your lease or negotiate a separate SUA with the lease.
6. Put together a list of issues important to you before you sit down and negotiate.
7. Document your land, air, and water quality and quantity before development begins. This way you will know and have legal proof if anything changes.
8. Negotiate the royalty on oil and gas. Mineral owners can get anywhere from 12.5% to 18% for gas and up to 25% for oil. Also make sure to require payments (preferably annually) for pipeline crossings, easements, right of ways, or surface use.

## Split Estate

Unfortunately few landowners own the controlling interest (51% or more) of the minerals under their land. Minerals by legal definition include coal, any valuable rocks, minerals or ore, and oil and gas. The average farm or ranch sits over a checkerboard of mineral parcels with owners

ranging from distant family members, previous landowners, absentees, corporations, and the state and federal governments.

How can the surface be separate from the minerals beneath? This separation was authorized by various federal Homestead Acts, including the 1916 Stock Raising Homestead Act. Today, if the surface and mineral rights conflict, the mineral rights take precedence. This allows minerals owners to develop those resources beneath the land, whether or not the surface owner agrees. There are some federal and state protections in law for the surface owner but many of those laws ultimately lead to the courts. Only a properly prepared landowner can ensure acceptable oil and gas development.

To understand what laws will apply to you, the best place to start is to find out who owns the minerals underneath your land. You can do this by calling the *Montana Department of Natural Resources and Conservation* (DNRC) for state information, the United States *Bureau of Land Management* (BLM) for federal information, or visiting the county courthouse with a legal description of your land. See the contact page at the end for contact information.

Once you determine who owns the minerals under your land, you can then look into the applicable laws. If you have state or private minerals under your land, state laws apply. If you have BLM minerals under your lands, federal laws apply.

## State Laws

As mentioned before, there are a number of state laws that can protect landowners and the community to some degree. However, these laws do not cover all the impacts of oil and gas development and in many cases it is up to the individual to make sure they are followed and enforced. A good understanding of these laws is necessary to recognize the areas that need to be addressed by BMPs.

As noted above, state laws apply only to state and private minerals. All applicable state laws can be found in the Montana Code Annotated and the Administrative Rules of Montana.

**Leasing State-owned minerals**

The oil and gas company interested in leasing the state minerals under a specific area can nominate the parcel for the upcoming lease sale. The Department of Natural Resources and Conservation holds lease sales quarterly (March, June, September, and December). Notification of those lease sales is required 15 days in advance of the sale in a general state-wide publication and on the DNRC's website. Surface owners are required to be notified of the lease sale by certified mail.

At the lease sale, the highest bidder on the particular parcel of land earns the right to develop the land providing that they meet all permitting requirements. There is a minimum bid of $1.50 per acre on each parcel leased, but leases can go much beyond that if there is competition. Most lease terms are granted for a ten year period and as long after that as the resource is being developed.

**Leasing privately-owned minerals**

Oil and gas companies hire representatives called landmen that research mineral ownership and contact the mineral owner in order to persuade them to lease. If a landowner does not own the mineral rights under the land, there is no requirement for notification if private minerals are leased underneath their land. If a person owns a significant portion (>50%) of the mineral rights, the landman will contact the person with the controlling interest and begin negotiations. The person with the non-controlling interest will still receive royalties if an agreement is negotiated.

**Surveying Private Land**

Once a lease is signed, the developer has the right of entry onto the land. A professional surveyor hired by the oil and gas companies is required by state law to give a 15 day notice to the landowner before entry[1]. Also, according to MT code "If a landowner acknowledges receipt of the notice within 15 days, the landowner may modify the access provisions of the notice, as long as the modifications do not unreasonably restrict completion of the survey." In addition to this, the landowner may request identification of the surveyor and their employer, a copy of the survey, and that all vehicles entering the land must be washed to avoid noxious weed seeds.

**Permitting**

The oil or gas company that leases the minerals is required to submit an *Application Permit to Drill* (APD) to the *Montana Board of Oil and Gas Conservation* (MBOGC) if they intend to develop the resources. The APD must be noticed in the paper in the county of the proposed drilling as well as the Helena newspaper[2]. Within 10 days of public notice, anyone has the opportunity to request a hearing before the MBOGC. The MBOGC can be reached at their Billings, MT office. See the contact page at the end of this document for contact information.

Below are the various other permits that may be needed for an APD:

1. Stream crossing permit (apply through county conservation district).
2. Air quality permit (apply through *Montana Department of Environmental Quality*).
3. Water discharge permit (apply through Montana Department of Environmental Quality).
4. Water use permit (apply through Montana Department of Natural Resources and Conservation).
5. Solid waste disposal permit (apply through Montana Department of Environmental Quality).
6. State lands drilling authorization (apply through Montana Department of Natural Resources and Conservation).

**Entry onto Private land**

1. Written Notice: Before drilling, the operator must give the landowner written notice of intended drilling operations and a plan of work no more than 180 days and no fewer than 20 days before activity begins[3]. If a landowner does not receive notice within this time frame, the operator may not begin drilling operations.

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[1] Montana Code Annotated 2009, 70-16-111 http://data.opi.mt.gov/bills/mca/70/16/70-16-111.htm

[2] Administrative Rules of Montana, 36.22.601 http://www.mtrules.org/gateway/RuleNo.asp?RN=36.22.601

[3] Montana Code Annotated 2009, 82-10-503 http://data.opi.mt.gov/bills/mca/82/10/82-10-503.htm

2. Bonds: The state requires bonds between $1,500 - $10,000 (depending on well depth), or a multiple well bond of $50,000. The amounts can, at most, be doubled at the discretion of the Montana Board of Oil and Gas Conservation. Bonds in many cases do not cover the full cost of reclaiming the well, especially when there are multiple wells under one bond. **Landowners who successfully negotiate a SUA can request bond levels that are greater than required by state law if needed.**

3. Surface Entry: After giving written notice, the operator has the legal right to enter your property, drill wells, build roads and pipelines, and generally maintain operations without your permission. The operator has to offer a surface use agreement but the landowner and company do not have to agree on it for them to enter your land[4]. If you are mineral owner with a majority of your minerals (51%) and you put a provision in your lease agreement and/or surface use agreement, you can negotiate terms that specify surface entry. Whatever your mineral ownership situation is, it is highly recommended that a strong surface use agreement is negotiated. However, despite what agreements you have in place, you do have the right to receive compensation for any damages that occur from oil and gas operations on your land.

**Development**

Once development begins there are not very many opportunities for the public to participate. For any questions on the process and all the laws governing well development, the Montana Board of Oil and Gas and Conservation (MBOGC) is the governing agency under state law. The MBOGC oversees well spacing, well drilling and production, surface disturbance, and reclamation. However, if there is a discharge permit granted for the well, the Department of Environmental Quality (DEQ) is the agency to contact. For any water rights issues such as loss of a well, the Department of Natural Resources and Conservation (DNRC) is the agency to contact.

**Reclamation**

Once development is finished, the company is required to provide written notice of the plugging and abandonment of the well or wells. The surface owner has the opportunity upon receipt of the notice and 15 days after to request that the well head is buried no less than 3 feet underground[5].

## Federal Laws

The BLM manages the federally-owned minerals available for oil and gas development. The BLM is responsible for issuing the drilling leases and managing the sub-surface operations, but other state and federal agencies may manage the surface operations when applicable. Through a *Memorandum of Understanding*, the MBOGC is the primary agency responsible for oil and gas development in Montana, but all BLM processes, rules and regulations are in effect.

**Leasing**

Lease sales for the BLM occur on a quarterly basis (January, May, July, and October). A notice of competitive lease sale, which lists lease parcels to be offered at the auction, is published by

[4] Montana Code Annotated 2009, 82-10-504 http://data.opi.mt.gov/bills/mca/82/10/82-10-504.htm

[5] Montana Code Annotated 2009, 82-10-401 http://data.opi.mt.gov/bills/mca/82/10/82-10-401.htm

each BLM State Office at least 45 days before the auction is held. A map of the general areas of the leases is also provided. Lease stipulations applicable to each parcel are specified in the sale notice. Leases are granted for a term of 10 years or as long as the well is producing.

**Permitting**

The operator of an oil and gas well must submit an Application for Permit to Drill or Reenter (APD) to the BLM. Prior to the submittal of the APD, it is recommended that the operator organize an initial planning conference with the BLM, another Surface Managing Agency when applicable, and the landowner to outline the initial plan and discuss special conditions on the lease area. The operator must also file a *Notice of Staking* (NOS) with the BLM prior to submitting the APD. With the NOS, the operator submits an application and stakes out where the proposed drill pad, well and additional infrastructure will be on the leased property. A site inspection will then take place with the BLM, or other Surface Managing Agency, the operator, and the landowner to develop a list of resource concerns that the operator must address in the APD. The BLM, or other Surface Managing Agency, must provide at least 30 days public notice before the BLM may approve the APD. The BLM is then responsible for determining if the APD is complete, and meets all requirements in the National Environmental Policy Act, Clean Water Act, Clean Air Act, National Historic Preservation Act, Endangered Species Act, and other applicable laws. The BLM then approves without conditions, approves with Conditions of Approval, or denies the APD. An APD is valid for two years, as long as the lease is still active.

**Entry onto Private land**

1. Before entering private property, a federal mineral lessee must negotiate to obtain consent for access, a waiver of consent, or an agreement detailing compensation for certain property damages. If an agreement cannot be reached, the operator can bypass this requirement by posting two bonds.

2. Bonds: Failure to reach an agreement requires posting of a surface use bond and reclamation bond with the BLM. The surface use bond must cover damages to crops, permanent improvements, and your land's grazing value. The bond must be provided along with a description of your right to appeal the amount of the bond. A second copy must be provided to the appropriate BLM officer. Review the bond carefully! If the bond is insufficient, it may be challenged within 30 days. If the BLM officer deems the bond sufficient, you have a right to appeal the decision. The reclamation bond must cover the cost of plugging the wells and reclaiming and restoring adversely affected land and surface waters. Standard bond amounts are $10,000 per lease, $25,000 for all leases in the state, or $150,000 for all leases in the nation.

**Development**

The BLM is the agency that oversees the development and maintenance of the well or wells in a development area. The BLM Montana/Dakota division is in charge of Montana's federally-owned minerals. The BLM is responsible for managing the well during the development stages and must approve any changes to the original permit. The operator must submit a request for approval to the BLM or appropriate Surface Managing Agency prior to any reconstruction or altering of roads, pits, flowlines or any other production facilities during the development and operation of the well. If the operator wishes to convert the oil or gas well into an injection well

(to dispose of produced water) or water supply well after it is no longer producing, they must submit the plan to the BLM for review.

**Reclamation**
Once a well is no longer producing, the operator must submit a Notice of Intent to Abandon. After receiving approval from the BLM, the operator must plug the well and reclaim the disturbed areas. The operator must reclaim the disturbed area to a productive use and meet the objectives of the land and resource management plan. Earthwork for interim and final reclamation must be completed within six months of well plugging. All roads, pads and pits must be reclaimed and revegetated unless an agreement exists between the landowner and operator to keep the roads or pads in place. All pit fluids must be removed or solidified before backfilling, and pits must not be breached.

# Best Management Practices for Well Development

Most of the BMPs listed below apply to the operator or company developing the well.

## **Leasing**: Obtaining the Right to Develop

- The surface owner should be notified of the pending lease 20 days prior to the state or BLM lease sale.

## **Exploration:** Discovery of the Resource

- The surface owner, as a vested stakeholder, should approve decisions regarding siting for wells, roads and other facilities prior to entry on lands. This may be addressed in the SUA.
- Landowners should be kept informed of the ongoing schedule of activities to prevent serious use conflicts, and operators should communicate with each other regarding land use activities that could result in conflict.
- Existing roads should be used for exploration activities. If roads are not already constructed, the operator should develop low impact two-track roads that follow the contour of the land or use overland travel where possible.
- The use of dynamite should be avoided during seismic exploration.
- Prior to exploration, the operator should investigate possible historical, archaeological or paleontological resources within a development basin or site.

## **Permitting:** Preparing to Develop the Resource

If a landowner does not own a controlling share (50%) of mineral rights under their property, they have very little control over the development on their land. The most important document that the surface owner has the opportunity to sign is a SUA. By state law, oil and gas companies are required to offer an agreement. However, if mutual agreement is not reached, the company can proceed to development without a SUA in place if they post a monetary bond.

State law does not require that the landowner has any control over the location or number of wells, roads, pipelines, settling ponds, facilities, noise, lights, or any other impact. Despite this, there are a few practices available to minimize the impacts and protect the existing uses of the land.

Early coordination on proposed oil and gas development is encouraged between the operator, regulatory agencies (including the Montana Board of Oil and Gas Conservation (MBOGC), Bureau of Land Management (BLM), United States Forest Service (USFS), Montana Department of Environmental Quality (MDEQ)), Sweet Grass County, and the land owner to ensure all parties' concerns are addressed through the regulatory process and/or private agreements. All involved should have the opportunity to participate and comment during the pre-development planning and permitting processes. Site visits are also necessary to ensure site-specific requirements (location of infrastructure, well density, etc.) of a proposed area are addressed during the exploration and pre-development phases.

The following describes oil and gas BMPs related to the pre-development and permitting processes:

- If there are federal minerals present, landowners and other interested parties should request the operator file a Notice of Staking (NOS) with the BLM prior to submitting the Application for Permit to Drill or Reenter (APD). The NOS requires the BLM to conduct a site inspection prior to submittal of the APD so that all parties can develop a list of resource concerns for the operator to address in the application.
- Proactive and early engagement with the operator is encouraged for local governmental entities and citizens.

- The APD submitted to the MBOGC, should **already** include the following:
  a. A survey plat certified by a registered surveyor.

  b. A topographic map showing the well location, the access route from county or other established roads, residences, and water wells within a 1/2 mile radius of the well.

  c. A sketch of the well site showing the dimensions and orientation of the site, the size and location of pits, topsoil stockpile, and the estimated cut/fill at the corners and centerstake.

  d. A description of the type and amount of material or liner, if any, to be used to seal the reserve pit. If a synthetic liner is used, indicate the liner thickness (mils), bursting strength, tensile strength, tear strength, puncture resistance, hydrostatic resistance, or attach the manufacturer's specifications.

e. A description of the proposed plan for the treatment and/or the disposal of reserve pit fluids and solids after the well is drilled. If the operator intends to dispose of or treat the reserve pit contents off-site, specify the location and the method of waste treatment and disposal.

- The APD **should** include the following in an additional drilling plan or Plan of Development (POD):
  a. Identification of land ownership.
  b. Identification of existing and expected surface uses (including number and spacing of wells, roads, pipelines, water storage and disposal facilities, treatment facilities, gathering and transmission pipelines, etc.).
  c. Identification of existing and required infrastructure and utility corridors.
  d. Map of the area with location of existing facilities (i.e. water wells) and potential (optimal) locations for future facilities, including production facilities (well sites, processing units, etc.), roads, flowlines, and utility corridors. The map can also include geographic features such as streams and other water bodies, and special ecosystems.
  e. Identification of no drill areas.
  f. Identification of regulatory requirements.
  g. A water management plan (see page 40 for more details).
  h. Identification of closure planning and a schedule including monitoring and maintenance for interim and final reclamation of disturbed areas and for final abandonment.
  i. Conflict resolution procedures.
  j. Strategy for establishing baseline conditions, monitoring programs (surface and subsurface water quality, wildlife and fish, air quality, etc.), and mechanisms to apply monitoring information to existing and future actions.
  k. An emergency services plan, including methods and time of notification, location and activation of fire suppression and fighting personnel and equipment, evacuation and treatment of injured personnel.
  l. A preliminary timeline of development showing the project build-out through closure.
  m. A noise control plan, including mitigation methods to be used by operator for compressors and other noise generating facilities located on or adjacent to the lands.
  n. A gas and water leak detection and remediation plan, including methods and time of notification, schedule and procedure for remediation.
  o. An automation plan, including methods, times, and access procedures for telemetric or other well control and data transmission.

## **Well Development:** Drilling the Well and Producing the Resource

The operator should:

- Acquire landowner approval in well-siting decisions. Contact the surface owner before staking access routes and well facility sites.

- Minimize surface disturbances and impacts with the use of alternative techniques, for example, directional drilling, drilling multiple wells from the same pad, recompletion, using existing well pads, pitless drilling, closed loop systems, and liquid gathering systems (LGS).

- Site and construct wells with the following considerations:
  a. Locate wells and production facilities near existing roads to reduce surface disturbance.
  b. Locate well sites in stable, non-erosive soil areas, with grass or brush cover and on relatively level areas that minimize pad construction. Choose sites that avoid steep slopes, unstable soils, stream bottoms, wetlands, floodplains and riparian areas.
  c. Wells should be sited **at least** 1,000 feet away from surface waters. Pipelines crossing water channels should be buried at least four feet beneath the channel. Pipelines that must span water courses should be within secondary containment to avoid releases to surface waters.
  d. Well pads should be constructed to fit the landscape to minimize impacts.
  e. Excavate the least amount of land possible. Only the rig and pit areas need excavation and make sure to stockpile topsoil. The rest of the drill area (staging, parking, etc.) should only be mowed to temporarily reduce vegetation.
  f. Where no code exists, locate facilities and roads **at least** 1,500 feet away from occupied dwellings, or at a distance where noise impacts do not cause a nuisance.
  g. Locate in visually acceptable areas (avoid dwelling view sheds) and paint facilities colors that blend in with the natural environment.
  h. Locate where safe access can be maintained year round.

- Develop and enact an interim reclamation plan. This plan should include tasks to complete after every stage of well development. Within thirty days after drilling is completed, ther operator should conduct interim reclamation to reduce the drill site to the minimum area required for production operations and restore the disturbed areas to their pre-disturbance condition, or better, pursuant to landowner preference. Interim reclamation should include the following:
  a. Separation and storage of topsoil during site preparation.
  b. Reclamation and recontouring of disturbed areas to be compatible with existing grades, including for agricultural purposes.
  c. Replacement of topsoil to at least the depth and quality that existed prior to disturbance for final reclamation of the site upon abandonment of the well.
  d. Revegetation of disturbed areas using a seed mixture to match native vegetation (or vegetation on site prior to disturbance) and result in a sustainable post-development ecosystem.
  e. Use of certified seed that is free of noxious weeds for reclamation.
  f. Removal all chemicals, equipment, materials, and waste not necessary for sustaining production from the well pad.

- Install at least three layers of steel pipe to prevent any casing failure or blowouts.

**Well Closure & Reclamation:** Shutting down Production & Cleaning up

- Always plan for reclamation prior to construction to ensure land returns to original structure/function. Address decommissioning and removal of surface facilities in reclamation plans. Facilities should be removed within seven days after they are no longer needed so that interim reclamation may begin.

- Operators must plug the well with the best suited material for each specific site. Bentonite, bentonite chips, neat cement grout and native clay are all effective materials used to plug wells. Selection of the material should be based on site-specific conditions.

- Remove all contaminated soil from site before applying top soil or seed. Contaminated soil must be disposed of at an approved landfill disposal site.

- Reclaim the site with weed-free native seed or hay mix. Reapply excavated top-soil promptly to fight noxious and invasive weeds. Apply weed-free mulch, logs, and boulders to the site for erosion control and creation of micro-habitats. The area should be analyzed by a reclamation specialist to determine which seed is needed and which seeding technique (broadcast, hydro, drill, etc.) is best for the specific landscape.

- Adequately prepare the disturbed area prior to seed application by ripping the surface to increase surface area to aide in trapping moisture and seed. Apply fertilizers and other amendments if needed.

- Recontour the entire site and all roads to original topography while maintaining original drainage systems. Ensure new topography blends in with the surrounding landscape.

- Design a long-term monitoring program to observe the site after the well is plugged and abandoned to ensure appropriate weed control and that vegetation is adequately established.

# Best Management Practices by Resource Impacts

Planning on a field basis is highly recommended in order to reduce community-wide impacts to roads, water, air, and land. This requires coordination between the private mineral owners or lessees, major and minor oil and gas companies, the county, the state and the federal government.

## Field Development for Well Production

- Construct common flowlines from several wells to a centralized storage/production facility to reduce environmental/visual impacts. This will also minimize the footprint at individual well sites and allow for lower standard roads to be constructed to each site. Traffic to individual well sites can also be reduced with the use of remote monitoring.
- Use a central gas gathering facility to minimize pipelines and surface impact. BMPs include the following:
  a. Route Identification and Description. Contact the surface owner before staking routes and facility sites. This provides an opportunity for mutual agreement about proposed locations and reclamation. Off-lease gathering and transmission pipelines should be located in existing utility or transportation corridors.
  b. Co-locating Water and Gas Gathering Lines and Roads. Locate roads and water and gas gathering lines in the same easement along a route agreed to with the surface owner. In general, for smaller tracts of land (160 acres or less) and tracts that may be subdivided later, roads and gathering lines should be located in designated utility easements or along property boundary lines to avoid splitting off unusable tracts.
  c. Rights-of-Way Width and Line Depth. Minimize the width of gathering line rights-of-way. Bury the top of each gathering line three feet below the surface, unless local rock outcrops and terrain prohibit such burial, and the exception is agreed to by the surface owner.
  d. Reclamation. Each gathering line should be double-ditched and topsoil should be restored in each disturbed location to at least the depth and quality that existed prior to such disturbance. Pipeline trenches should be compacted during back-filling. After installation, repair or other surface disturbance, the operator should promptly reclaim the surface, recontouring to conform to existing grade, revegetating with a seed mixture specified by the surface owner, and filling of any settled areas with comparable quality topsoil. For reclamation, use only certified seed free of noxious weeds.
  e. Pipeline Agreements. Pipeline agreements should routinely allow the overlapping of pipeline rights-of-way so pipeline areas are consolidated.
  f. Roads**.** Use the same standards/criteria as noted in (b) for constructing roads to metering and compressor sites.
- If the soil type allows, use the plowing and pulling pipes method for burying lines and utilities instead of excavating and trenching. Use ditch witches or wheel trenchers (versus back hoes) wherever practical for installation of buried lines.

- Exercise proper storm water management strategies such as: diverting storm water away from the well location with the use of berms and ditches, and trapping storm water within the well location with the use of retention ponds and sediment fences. Ensure proper installation of culverts to prevent soil erosion. Construct proper culvert outlet controls (such as rip-rap) to slow water velocities and prevent soil erosion.

- Slope areas used as storage for petroleum products, generators, mud tanks to provide drainage to the reserve pit. Alternatively, secondary containment units should be constructed for all petroleum storage facilities and be in concordance with EPA's Spill Prevention, Control, and Countermeasure regulations (40 CFR 112).

- Store hazardous chemicals including petroleum, reagents and potentially drilling muds in well-maintained containers within secondary containment. All hazardous chemicals should be properly labeled, and stored to avoid constant direct exposure to the sun or moisture. Hazardous waste materials must be properly stored, tracked, and disposed of in concordance with the Resource Conservation and Recovery Act (RCRA).

- Use directional drilling to reduce impacts from constructing multiple well pads, the total road network, truck traffic and dust emissions.

## Water Quality and Quantity

- A Water Management Plan should be prepared by the operator addressing the following:
  a. Preferences and concerns should be addressed early in the planning process and throughout the development of Water Management Plans (WMPs) by consulting with surface owners and affected water users.
  b. Quantity and quality of water to be discharged (if operator has plans for discharge). Direct discharge to surface waters must be avoided. A deep gas or oil well that is hydraulically fractured can use between 1-8 million gallons of water per fracture. Wells can be fractured multiple times throughout their lifespan.
  c. Quality of receiving water standards and protection of groundwater and surface water by establishing **baseline water quality conditions through monitoring**. Water quality parameters to be tested include all of the chemicals used in hydraulic fracturing fluid including benzene, toluene, ethylbenzene, xylene, naphthalene, polynuclear aromatic hydrocarbons, hydrochloric acid, formaldehyde, ethylene glycol and sodium hydroxide; and standard parameters including alkalinity, aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chloride, chromium, copper, fluoride, iron, lead, magnesium, manganese, mercury, nickel, nitrate, nitrite, pH, potassium, selenium, silver, sodium, sulfate, thallium, total dissolved solids, uranium, zinc, bismuth, cobalt, gallium, lithium, molybdenum, phosphorus, scandium, strontium, tin, titanium, and vanadium.
  d. Use of non-toxic fracking agents (whenever feasible).
  e. Environmental/ecological effects from surface discharge and their associated mitigation measures.
  f. Beneficial use possibilities for waste water, such as road dust suppression.
  g. Proximity to streams/ponds/reservoirs/wetlands/lakes.

h. Hydrology and hydrogeology of the area. This report should indicate locations of water wells, springs, lakes, rivers and streams within the basin that may be affected by oil and gas development.
i. Long-term impacts to the environment.
j. The laws, regulations and policies that would apply to the development of the operation. These will vary by locality. For example, when considering underground injection, ensure that the components of the underground injection control program can be met, whether the EPA is administering the program or an individual state has received primacy for the program. Certain design and operating requirements should be researched through the appropriate jurisdictional agency (either the EPA or the primacy state) to ensure a complete application for approval is submitted. In Montana the MBOGC has primacy.
k. Mitigation of surface water discharge effects, i.e., headcuts, road crossing, impoundments, channel stability.

l. Use of pitless drilling, closed loop systems, and liquid gathering systems (LGS) to the extent practicable to reduce amount of water used and the potential for contamination of surface waters.

- Allow government and public access to the complete chemical composition of an operator's hydraulic fracturing fluids. Avoid using hydraulic fracturing fluids that contain chemicals that are toxic to humans and wildlife. These fluids may contaminate groundwater sources that would otherwise be of high enough quality to be considered an underground source of drinking water.

- Pitless drilling is preferable, but for sites where reserve pits are allowed, the following BMPs should be enacted:
  a. Do not construct reserve pits in areas with shallow groundwater. Construct pit dikes with properly compacted lifts. Design pit to always maintain at least two feet of freeboard. Properly line reserve pits with a synthetic liner or clay (such as bentonite). The liner should have a permeability of less than $10^{-7}$cm/sec. Synthetic liners should be more than 12 mils thick and show resistance to chemicals, ultraviolet radiation, weathering, punctures, and tearing. A combination of a clay layer followed by a synthetic liner is desirable.
  b. A leak detection system including moisture probes, lysimeters and groundwater wells should be used to ensure integrity of the pit.
  c. Fencing should be required around the pit at all times. A fully enclosed net may be necessary to keep birds from reaching the water.
  d. The pit should constantly be kept clear of oil and other petroleum products. As soon as a visible sheen is present, clean-up operations to remove the oil should be initiated. Oil booms, skimmers, and other cleaning materials should always be present on site.

- Recycle processed water to the extent practicable after contaminants have been removed.

- Install proper equipment to treat and monitor water/mud/cuttings before releasing to the reserve pits, and use a closed mud system to reduce water accumulation in pits.

- Case and cement all wells to protect groundwater. Wells should use 3 layers of steel pipe to prevent any casing failure or blowouts.

- Conduct inspections of water quality and stormwater runoff after periods of heavy rain or snowfall.

- Avoid direct discharge of any fluids used in drilling or fracturing to surface waters.

## Air Quality

- Monitor baseline air quality of the entire gas field prior to development.

- Coordinate with local stakeholders on air quality management. Operators should contact the appropriate regulatory agency to ensure compliance and coordination of air quality requirements. Particulate matter in the air is measured as $PM_{10}$ (particles with a diameter of 10 μg or less). The 24-hour Montana Ambient Air Quality Standard for $PM_{10}$ is 150 $\mu g/m^3$. The annual $PM_{10}$ standard is 50 $\mu g/m^3$. There currently is no State or Federal standard for hourly $PM_{10}$ data.

- Local government entities should consider adoption of air quality requirements, or alternatively, develop a cooperative program with the state of Montana to ensure air quality standards are achieved or exceeded.

- Develop extensive Air Quality Monitoring Program to measure current conditions and compare with future measurements.

- Establish a dust control plan. Reduce dust emissions with the use of water, magnesium chloride, pavement, gravel, or lignin derivatives.

- Create a detailed transportation schedule to minimize trucking and service traffic to reduce dust and tailpipe emissions. The use of telemetry, remote measuring/monitoring/control, reduces the need for multiple trips to the site to measure or monitor well progress.

- Design a temporary water distribution system with a centralized storage facility and plastic surface water lines. This reduces the need for water truck transport, thus reducing traffic.

- Develop a carpooling or busing program to transport employees to and from sites.

- Develop a Directed Inspection and Maintenance Program to identify and fix fugitive gas leaks. Leak detection techniques include infrared cameras, organic vapor analyzers, soap solutions and ultrasonic leak detectors.

- Use equipment on wells and storage facilities that will capture Volatile Organic Compounds (VOCs).

- Reduce particulates. Emissions of particulate matter from construction and road use should be minimized by reducing traffic whenever possible and with various techniques such as directional and horizontal drilling, liquid gathering systems (LGS) and the application of water, gravel, or other dust suppressants, with at least 50 percent control efficiency. Companies should contact the counties to ascertain the procedures to be followed on county roads and should post and obey speed limits set by local authorities.

- Reduce Emissions. Operators should reduce total emissions from gas operations by using tier 3 and 4 engines, or natural gas drilling equipment and flareless "green completions". EPA has joined with companies across all sectors of the natural gas industry to reduce methane emissions through a voluntary partnership known as the EPA Natural Gas STAR Program (http://www.epa.gov/gasstar/index.htm). Systems that capture natural gas upon well completion rather than venting or flaring can then sell the captured product. These methods have high initial costs but returns typically occur within 1 to 3 years.

- Use electrical power when a power grid is accessible, electrical power is a cleaner alternative to generators. Solar power may be utilized to power telemetry units and chemical pumps.

- Use fully enclosed tanks instead of open pits to reduce fugitive emissions and environmental impacts. Vapor recovery units may be used on tanks to capture hydrocarbon-rich vapors to use on site or sale. These units collect and store vapors escaping from petroleum tanks.

- Ensure quality hatches, seals and valves are used and maintained properly on site.

- Upgrade equipment and machinery to reduce emissions and increase gas recovery. Research new or upcoming technologies that will improve efficiencies on site. Some ideas for upgrades include:
  a. Flash Tank Separators
  b. Selective Catalytic Reduction
  c. Install dry seals in centrifugal compressors
  d. Replace high-bleed devices with low-bleed
  e. Plunger Lift System and Automated Systems

## Noise Impacts

- Control noise levels. Gas operations generate noise that can impact established receptors (for example residences, churches, schools, established campgrounds or sensitive wildlife). Control of noise is required. If low frequency noise becomes an issue, it should be addressed by the operator in consultation with those being affected.

- Apply noise mitigation measures in areas close to residential properties or areas where noise pollution will impact wildlife.

- Create site specific day and night noise pollution standards not to be exceeded. After initial construction of a well or facility is completed, no engine, motor, compressor, piece of equipment and/or facility installed or operated by Operator on the Lands, excepting only workover rigs, shall exceed the standard of 48.6 dB(A) Leq at a distance of 200 feet in any direction from the applicable equipment. Additionally, prolonged exposure to noises over 65 decibels may cause mental and health fatigue. A recommendation from the Powder River Basin Oil and Gas Project specifies that noise levels will not exceed 50 decibels above background noise one-quarter mile from source.

- Properly locate compressor facilities such that sounds generated do not interfere with human or wildlife activities.

- Identify areas where the use of jake brakes on trucks may be a nuisance. Install proper "no jake brake" signage within that area.

- Utilize obstacles as a noise abatement measure. These obstacles can be tightly spaced wood fences (no gaps in the wood panels), engineered noise barriers, concrete fences, earthen berms, structures, straw bale "zig-zag" design structures or naturally occurring hills. Care must be taken even with a tightly spaced wood fence. Even a small opening between the individual slats on a fence can allow a pathway for noise to transit through the opening.

- Obtain sound muffling equipment for all engines when feasible. Noise barriers (such as foam insulation around drilling rigs) should also be considered.

- Abate compressor and pumpjack equipment noise. The following measures can help abate compressor and pumpjack equipment noise:
  a. Utilize compression equipment that reduces or alleviates noise (e.g., properly selected hospital grade mufflers matched to the noise reduction being sought).
  b. Use design retrofits to reduce or alleviate noise associated with older compression equipment.
  c. Locate equipment to take advantage of surface topography to aid in noise abatement, etc.
  d. Install high-grade mufflers on the exhaust of compressor engines, well site, and facility engines to reduce the exhaust noise.
  e. Consider the use of multi-blade fan configuration on the cooling fan.

f. Utilize electric power when possible (rather than diesel).
g. Consider placing compressors underground, or construct earthen berms to limit noise.

## Visual Impacts

- Minimize the footprint of well locations, access roads and utilities by using existing well pads where feasible. Avoid creating large cut and fill slopes, minimize clearing, taking into consideration state and local well-spacing requirements. Use directional and horizontal drilling whenever possible.

- Encourage siting of power lines underground where possible and a minimum number of poles.

- Use vegetative and topographic screening when siting well and facility locations, avoid highwall cuts, and reclaim all portions of the location not needed for production facilities.

- Facilities should be painted a color which allows the facilities to blend with the background, typically a vegetated background.

- Design and plan lighting needs to minimize light disturbance to surrounding neighbors.

- Avoid construction of facilities on ridge tops. These are highly visible from great distances as they are skylined. Roads may be constructed on ridge tops to reduce visual impacts.

- Site facilities in order to blend in with the background and appear smaller or hidden all together. Locate facilities in swales, behind ridges, or around bends, to hide them. An artificial berm may be constructed and vegetated to screen the units. Do not locate facilities near prominent features or landmarks.

- Install low profile structures, such as a submersible pump, to aide in reducing visual impacts. Wells can even be positioned fully underground with a steel lid to keep people and wildlife out.

## Social and Economic Impacts

- Owners should present multi-year development forecasts to local governments to assist in community planning efforts.

- Create a community relations program to help mitigate industrial impacts to local communities, and to increase communications between the industry and local communities.

- Adopt a zero-tolerance drug policy. Ensure all subcontracts adhere to anti-drug policies and drug testing requirements.

- If roads are constructed in urban areas, build footpaths adjacent to the road for the safety of the public.

- Avoid construction in scenic or recreational areas.

- Institute a corporate-funded rewards program for information leading to conviction of criminals (poaching, drug usage, drunk driving, etc.).

- Open company/project information to the public for scrutiny.

- Install proper signage on site to notify the public of possible dangers and numbers to call in case of emergencies.

## Pests and Noxious Weeds

- Develop a detailed noxious and invasive weed control plan to prevent weeds from establishing on site. This plan should be in effect during all steps of the site development (exploration to site-closure).

- Discuss proposed pest and weed management plans with the surface owner and permitting agency as part of the planning process. Application of and use of herbicides for weed control must follow applicable local and state regulations. Approved permits must be obtained before implementing plans as required.

- Use certified weed free mulch for reclamation.

- Moist soils near wetlands, streams, lakes or springs in the project area should be promptly revegetated if construction activities impact the vegetation in these areas. Revegetation should be designed to avoid the establishment of noxious weeds. As noted with reclamation, use only certified seed that is free of noxious weeds in any revegetation operation.

- Waste handling, construction practices and operations should take into consideration pests such as mosquitoes (which can potentially transmit West Nile Virus – of significant concern for wildlife, as well as humans), rodents, flies, and other pests that may cause problems.

- Vehicles and machinery contaminated with soil can be sources of non-native noxious weed seed, which can seriously degrade native habitats. When moving vehicles and machinery from areas containing populations of noxious weeds, wash vehicles prior to entering gas development areas.

- It is important for companies to plan for the condition of the surface lands after active use. It is likely that the use will have changed the soils and habitat characteristics of that immediate land and non-native weed infestation is very likely. Reclamation plans should include post-activity weed and soil restoration considerations.

## Wetland/Riparian Areas

- Avoid any and all construction within wetland and riparian areas. Develop site-specific mitigation plans during the permit approval process for all proposed disturbance to wetland/riparian areas when they cannot be avoided.
- For power lines, use the minimum number of poles necessary to span the area, and avoid placement of poles in wetland/riparian regions.
- Schedule construction in wetland areas to minimize the duration of construction activity within the wetland, and to concentrate such activity during dry conditions (that is, during late summer or fall), or when the ground is frozen during the winter.
- Waste material should not be disposed of below high-water lines in riparian areas, flood plains, or in natural drainage ways.
- Locate the lower edge of soil or other material stockpiles outside the active floodplain.
- Locate drilling mud pits outside of riparian areas, wetlands and floodplains.
- Begin reclamation of disturbed wetland/riparian areas within thirty (30) days after project activities are complete.
- Conduct stream channel monitoring for erosion, degradation, and riparian health.

## Habitat and Species Protection

- Minimize traffic and disturbance in and near wildlife habitat, wetlands, winter range, birthing and rutting areas, and other environmentally sensitive areas. Examples of ways to accomplish this objective are to minimize access, to employ liquid gathering systems (LGS) and to use telemetry in monitoring wells.
- Bury utilities in and near areas of sensitive species critical habitat.
- Minimize the disturbance footprint by burying utilities along the road rather than cross-country.

## Roads and Transportation

- Development of a master design for a road network accounting for present, past and future developments should be included in a Master Drilling and Development Plan. All necessary upgrading of roads should be done prior to any gas development according to County growth policy or development guidelines. There should be no “shortcut roads” that deviate from the master road plan. Bury utility lines within these roads where possible.

- Following well plugging and abandonment, the access road should be left in the condition prescribed by the surface owner. If complete reclamation is required, the access road should be recontoured back to the original land shape and the topsoil replaced.

- Institute a road-use agreement where the operator funds provide for upgrades and repairs to local private and county roads impacted by oil and gas development activities.

- Use existing roads where practical. If an existing road is present, but not suitable, reclaim the obsolete road and then construct the new road.

- Use a primitive two-track road for exploration wells that have a marginal potential to produce. If the well is developed for production, then construct a road that accommodates their intended function, and no more. A two-track road may still be practical for a production well that requires very little traffic.

- Initiate interim reclamation of roads directly after construction. Reapplying topsoil, contouring and revegetating the roads after construction will decrease reclamation costs once the well is depleted.

- Limit site access to authorized employees only.

- Install proper signage along roads to control driver's speed and inform drivers of possible obstacles or dangers on the road.

- Install speed bumps when necessary to control dust and traffic. The operator could fund a regulatory program to enforce road regulations.

## Public Safety around Gas Infrastructure

- Unless otherwise required by state or federal requirements, provide operational information and post necessary signs to minimize accidents. Post telephone number for emergencies.
- Minimize entrance by unauthorized personnel through effective site security or barriers.
- Educate schools and communities about the dangers of going near gas activities. Provide educational courses for the local communities regarding oil and gas development with an emphasis on safety.
- Residents should be made aware of emergency procedures and be supplied with emergency phone numbers for emergency services. Each operator should have an emergency management plan in place that is shared with state and local emergency management authorities.
- Provide Material Safety Data Sheets (MSDS) for all site chemicals to local emergency personnel.
- Site wells with a plan for dealing with explosions in mind.

# Conclusion

Numerous communities across the US have been overwhelmed by the impacts of oil and gas development and have lost the social, cultural and environmental qualities that define them. The boom hits suddenly, the community expands overnight, and once the boom has passed, it is difficult for the community to return to the past.

This is why when oil and gas development occurs in a community, steps must be taken to ensure that the community remains true to what enticed people there in the first place. Ask yourself what do you value about life in Sweet Grass County? What attracts people to live here? What is worth protecting? Only when these values are outlined can a community truly address how best to co-exist with gas development. Cottonwood Resource Council has tried to address these underlying questions when creating this document in conjunction with Kuipers and Associates in hopes that the community that we work and play in retains its small-town, close-knit feel during gas development and after it has finally run its course.

Consequently, when there is potential for oil and gas development in a county, early collaborative efforts between oil and gas companies, local government and county citizens are needed to ensure that responsible development of the resource occurs with minimal impact to the community. These collaborative efforts, along with phased development using BMPs can beneficially effect both development and its aftermath, thus being profitable for all participants.

# Glossary

*Application Permit to Drill (APD):* A required step in the development process where the oil or gas operator applies to the appropriate agency for a permit to drill.

*Best Management Practices (BMPs):* BMPs are the tools and specific steps that companies and the community should take to ensure that gas and oil developers are using the safest and most up-to-date technologies to extract the resource and reduce the potentially negative impacts to water, range land soils and grasses, air quality, wildlife, and the community

*Bureau of Land Management (BLM)*: The federal agency that oversees oil and gas development of federal minerals.

*Closed Loop System:* "In a closed-loop drilling fluid system, the reserve pit is replaced with a series of storage tanks that separate liquids and solids. Equipment to separate out solids (e.g., screen shakers, hydrocyclones, centrifuges) and collection equipment (e.g., vacuum trucks, shale barges) minimize the amount of drilling waste muds and cuttings that require disposal, and maximize the amount of drilling fluid recycled and reused in the drilling process. The wastes created are typically transferred off-site for disposal at injection wells or oilfield waste disposal facilities." (Earthworks website)

*Compressor station:* A station that collects the oil or gas and compresses it in order to transport it to market via a pipeline. Compressor stations usually are quite loud and can be a nuisance if located near residents.

*Directional Drilling*: A technique where wells are drilled in a variety of different directions from a single well pad. Horizontal wells that tap unconventional oil and gas resources primarily use directional drilling.

*Green Completion:* The process of completing a well with specific pollution control equipment installed. The equipment separates out the gases, vapors, and other substances.

*Hydraulic fracturing:* Hydraulic fracturing or fracking is a process in oil and gas development that involves pumping toxic chemical and synthetic sands under high pressure into the ground to fracture the rock and bring the oil and/or gas to the surface.

*Memorandum of Understanding (MOU)*: A written agreement that is not legally binding but is a more formal contract than a verbal agreement.

*Montana Board of Oil and Gas Conservation (MBOGC)*: The Montana state agency that oversees oil and gas development on state and private minerals. According to the Board's website their goals are "(1) to prevent waste of oil & gas resources, (2) to conserve oil & gas by encouraging maximum efficient recovery of the resource, and (3) to protect the correlative rights of the mineral owners, i.e., the right of each owner to recover its fair share of the oil & gas underlying its lands. The board also seeks to prevent oil and gas operations from harming nearby land or underground resources. It accomplishes these goals by establishing spacing units, issuing drilling permits, administering bonds (required to guarantee the eventual proper plugging of wells and restoration of the surface), classifying wells, and adopting rules."

*Montana Department of Environmental Quality (DEQ)*: The Montana state agency that oversees water quality issues in relation to oil and gas development. The DEQ issues waste water permits, air quality permits, and storm water permits, and waste disposal permits for oil and gas operations.

*Montana Department of Natural Resources and Conservation (DNRC):* The Montana state agency that deals with water rights issues in relation to oil and gas development.

*Notice of Staking (NOS)*: A document required by the BLM that according to the BLM website serves to "provides notice to the Bureau of Land Management (BLM) that staking has been (or will be) completed for well locations on Federal or Indian leases and serves as a request to schedule an onsite inspection."

*Pitless Drilling:* See closed loop system.

*Split Estate:* A situation where the mineral estate is severed from the surface estate. The mineral estate takes precedence over the surface which allows oil and gas companies to develop wells without consent from the surface owners.

*Surface Use Agreement (SUA):* A surface use agreement, or surface damage agreement, is a legally-binding contract that includes, if negotiated properly, siting measures for wells and other infrastructure, directions for use of the land, water, and property, and certain compensation steps should damage occur to your property as a result of oil and gas activities.

# References

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United States Department of the Interior and United States Department of Agriculture. 2007. "Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development". Bureau of Land Management. Denver, Colorado. 84 pp.

Western Organization of Resource Councils (WORC). *Coming Clean : What we should know about oil and gas chemicals.* <http://worc.org/oil-gas-coalbed-methane/>

# Important Contacts

**State:**
Montana Department of Natural Resources and Conservation (DNRC)
Minerals Leasing Section
P.O. Box 201601
Helena, MT 59620
(406) 444-4576
http://dnrc.mt.gov/

Montana Board of Oil and Gas
2535 St. Johns Avenue
Billings, MT 59102
(406) 656-0040

http://bogc.dnrc.mt.gov/default.asp

Montana Department of Environmental Quality (DEQ)
1520 E. Sixth Avenue
P.O. Box 200901
Helena, MT 59620-0901
(406) 444-2544
http://www.deq.mt.gov/default.mcpx

**Federal:**
US Bureau of Land Management (BLM) - Montana/Dakotas State Office
5001 Southgate Dr.
Billings, MT 59101
Phone: 406-896-5000
http://www.blm.gov/mt/st/en.html

**Private:**
Visit the Clerk and Recorder's office at the local courthouse - any county

Sweet Grass County Clerk and Recorder
PO Box 460
Big Timber, MT 59011
(406) 932-5152

Cottonwood Resource Council
PO Box 1105
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