4. ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

This section of the environmental assessment (EA) provides an analysis of the potential environmental consequences that would result from implementation of the proposed Bowdoin Natural Gas Project.

An environmental impact or consequence is defined as a modification or change in the existing environment brought about by the Proposed Action or alternatives to the Proposed Action. Impacts can be direct or indirect in nature, and can be permanent (long-term) or temporary (short-term). Impacts can vary in degree ranging from only a slight discernible change to a drastic change in the environment. Short-term impacts are impacts that occur during and immediately after construction and testing and last from two to five years. For purposes of this EA, short-term impacts are defined as lasting five years or less. Long-term impacts are impacts imposed by construction and operations that remain longer than five years and extend for the life of the project, or LOP (in this case, 30–50 years) and beyond.

The description of the environmental consequences for each resource section in this section includes the following subsections:

Impacts. The impacts, including level and duration, that would occur as a result of one of the Action Alternatives or the No Action Alternative.

Mitigation. A summary of additional measures that could be applied to avoid or reduce impacts. Mitigation items specified in the Mitigation Summary are *assumed to be* applicable to impacts on all lands, regardless of ownership. However, the Operators would coordinate with private land-owners to determine which measures would be applied, to what degree, and where. Also, because of the similarity between the Proposed Action and No Action, it is assumed that the mitigation described applies to both alternatives. The measures identified under this section would be considered for application on public lands administered by the BLM. If no additional mitigation is proposed, the mitigation and residual impact sections will not be discussed.

Residual Impacts. A summary of impacts that are unavoidable and cannot be reduced or eliminated through the application of available and reasonable mitigation and, therefore, would remain throughout the duration of the project and to some point beyond.

Cumulative Impacts. A description of impacts likely to occur due to this project in combination with other ongoing and recently approved activities, recently constructed projects and other past projects, and projects likely to be implemented in the near future (reasonably foreseeable developments or RFDs).

Unavoidable adverse impacts, short-term use of the environment versus long-term productivity, and irreversible and irretrievable commitment of resources are discussed in separate sections following the discussions of the specific resources (Sections 4.14, 4.15, and 4.16 respectively). Unavoidable adverse impacts cannot be avoided and cannot be completely mitigated. Short-term use of the environment covers the LOP, whereas long-term productivity refers to the period after the project is completed and the area reclaimed. Irreversible and irretrievable impacts are permanent reductions or losses of resources that, once lost, cannot be regained.

4.1 AIR QUALITY

Air pollutant emissions would occur from the BNGPA during well site construction activities and field production, and these emissions would impact air quality in the project area. The primary pollutants emitted would be particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC), sulfur dioxide (SO_2), and hazardous air pollutants (HAPs) including formaldehyde and small amounts of benzene, toluene, ethylbenzene, and xylene. Emissions of these air pollutants would occur temporarily during well and field infrastructure construction and during production operations occurring over the LOP.

Air quality impacts from the emission of these pollutants are limited by regulations, standards, and implementation plans established under Title 75 of the Federal Clean Air Act and State of Montana, Montana Code Annotated, as well as Title 17 of the Administrative Rules of Montana as administered by the Montana Department of Environmental Quality – Air Resources Management Bureau (MDEQ–ARMB). Under FLPMA and the Clean Air Act, the BLM cannot conduct or authorize any activity that does not conform to all applicable local, state, tribal, or federal air quality laws, statutes, regulations, standards, or implementation plans. As such, significant impacts to air quality from project-related activities would result if it is demonstrated that:

- National Ambient Air Quality Standards (NAAQS) or Montana Ambient Air Quality Standards (MAAQS) would be exceeded; or
- Class I or Class II PSD Increments would be exceeded; or
- Air Quality-Related Values (AQRVs) would be impacted beyond acceptable levels.

All NEPA analysis comparisons to PSD Class I or Class II increments are intended to evaluate a threshold of concern, and do not represent a regulatory PSD Increment consumption analysis. The determination of PSD increment consumption is an air-quality regulatory agency responsibility. Such an analysis would be conducted to determine minor source increment consumption or, for major sources, as part of the New Source Review process. The New Source Review process would include an evaluation of potential impacts to AQRV such as visibility, aquatic ecosystems, flora, fauna, etc., performed under the direction of federal land managers.

4.1.1 Alternative A—No Federal Action

Direct and Indirect Impacts

Under the No Action Alternative, emissions as well as their associated impacts would be expected to be less than under the Proposed Action (Alternative B). Only the proposed fee and state wells and associated infrastructure would be developed with no development on federal lands. Under this scenario, up to 558 private and 62 state wells would be developed over a LOP of 30–50 years. Fewer wells and associated equipment over roughly the same time period as proposed for the Proposed Action would lead to a smaller magnitude of overall emissions and therefore a smaller impact to the ambient air quality in and around the project area. As a result, based on the analysis of the Proposed Action below, impacts during construction activities as well as during the production phase of the project would be below all ambient air quality standards and PSD increments, and would not significantly affect AQRVs.

Cumulative Impacts

Air-pollutant emissions would occur in the BNGPA during construction and production activities within the field. Nitrogen oxides (NO_x) from natural-gas combustion sources emitted over the LOP would be the primary pollutant emitted in the field and would result in increased ambient concentrations of NO_2. The NO_x emissions from the BNGPA would combine with emissions from other regional sources to produce cumulative air-quality impacts. The BNGPA is located in an area of Montana with limited industrial activity and cumulative emissions sources in the area are limited mostly to existing gas exploration and production activity. Cumulative air-quality impacts are defined as incremental impacts from any one alternative combined with impacts from other existing or proposed air-emission sources in the region, including existing sources within the BNGPA.

The increase in NO_x emissions in the BNGPA from the No Action Alternative could contribute to an increase in cumulative NO_2 concentrations and AQRVs impacts, including visibility degradation (regional haze) and nitrogen deposition, at the federal PSD Class I, UL Bend Wilderness Area and the MDEQ-ARMB Class I, Fort Peck Indian Reservation. Based on analyses of the Proposed Action below, the expected contribution of No Action Alternative impacts to cumulative ambient air concentrations and AQRVs including regional haze and N deposition at these distant areas is expected to be negligible. In addition, the cumulative concentration impacts at locations within the BNGPA would be below ambient air-quality standards. Therefore, cumulative impacts under the No Action Alternative are expected to remain in compliance with all applicable standards and not contribute significantly to any

4.1.2 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts

Air-pollutant emissions from the construction phase of the Proposed Action would occur during construction of well pads and access roads, and would be caused by diesel-fired heavy construction equipment, diesel-fired well drilling engines, pipeline construction, travel on unpaved roads to and from the construction sites, and wind erosion of disturbed areas. Specifically, PM_{10} and $PM_{2.5}$ emissions would result from well pad, access road, and pipeline construction and travel on unpaved roads, and NO_x, CO, VOC, SO_2, and HAP emissions would occur from drilling engine operation, flaring during well completion operations, and from tailpipe emissions from heavy construction equipment. Well pad and road construction would occur along the linear project facilities (roads and pipelines) and at multiple and widespread locations within the project area. The existing road network within the project area would be used for access to the greatest extent possible to avoid unnecessary additional surface disturbances.

Air-pollutant impacts from construction of each well would be temporary (i.e., occurring during well or pipeline construction) and would occur in isolation, without significantly interacting with sites under concurrent construction. While air emissions from fugitive dust and diesel combustion may occur at increased levels at locations adjacent to well and road-construction sites, potential impacts would be temporary and would not violate ambient air quality standards, PSD increments, or significantly impact AQRVs.

To determine an estimated impact from a typical drill rig operating in the project area, EPA's SCREEN3 model was run to estimate near-field concentrations of NO_2 and SO_2 produced from the drill rig engines. Emissions for the drill rig were based on EPA's AP-42, Section 3.3, Gasoline and Diesel Industrial Engines; and from engine parameters provided by the Operators, (170 hp, diesel fired, Tier 0 engines). The SCREEN3 model predicted near-field concentrations

for the drill rig that fall well below all MAAQS/NAAQS. Results of these test runs are summarized in Table 4.1-1 below.

Table 4.1-1. Maximum Predicted Concentrations from a Typical Drill Rig Compared to MAAQS/NAAQS Standards

Pollutant/Averaging Time	Direct Modeled Concentration ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	MAAQS/NAAQS ($\mu g/m^3$)
Nitrogen Dioxide (NO_2)				
1-hour	98.0[1]	75	173.0	564/NA
Annual	7.9[1]	6	13.9	94/100
Sulfur Dioxide (SO_2)				
1-hour	1.8	35	36.8	1300/NA
3-hour	1.6	26	27.6	NA/1300
24-hour	0.7	11	11.7	262/365
Annual	0.1	3	3.1	52/80

[1] Adjusted using EPA's Ambient Ratio Method (ARM) factor of 0.75.

Air-quality impacts from the production phase of the Proposed Action would occur over the LOP from increased compression in the field, generator engines used for artificial lift systems, as well as increased Operator traffic to service the additional wells and associated infrastructure.

The Operators are proposing the addition of four new compressor stations. Two of these stations would be powered by 600hp Ajax DPC-2803LE engines and two would be powered by 400hp Ajax DPC-2802LE engines. In addition, the Operators are proposing to add two of the 400hp engines to existing compressor stations in the field, for a total of six new compressor engines. These new compressors would be sources of NO_x, CO, VOCs and formaldehyde (H_2CO). Emissions estimates from these proposed compressors can be found in Table 4.1-2 below:

Table 4.1-2. Proposed Compression Emissions

Proposed Ajax Compressor	hp	Emission Rate (g/hp-hr)				Emissions (lb/hr)				Emissions (tpy)			
		NO_x	CO	VOCs	H_2CO	NO_x	CO	VOCs	H_2CO	NO_x	CO	VOCs	H_2CO
DPC-2803LE	600	2.0	1.4	1.3	0.3	2.7	1.9	1.7	0.4	11.6	8.1	7.5	1.7
DPC-2803LE	600	2.0	1.4	1.3	0.3	2.7	1.9	1.7	0.4	11.6	8.1	7.5	1.7
DPC-2802LE	400	2.0	1.2	1.3	0.3	1.8	1.1	1.2	0.3	7.7	4.6	5.0	1.2
DPC-2802LE	400	2.0	1.2	1.3	0.3	1.8	1.1	1.2	0.3	7.7	4.6	5.0	1.2
DPC-2802LE	400	2.0	1.2	1.3	0.3	1.8	1.1	1.2	0.3	7.7	4.6	5.0	1.2
DPC-2802LE	400	2.0	1.2	1.3	0.3	1.8	1.1	1.2	0.3	7.7	4.6	5.0	1.2
Total Proposed	**2,800**	**--**	**--**	**--**	**--**	**12.6**	**8.2**	**8.2**	**2.0**	**54.0**	**34.6**	**35.0**	**8.2**

The Operators are also proposing the installation of artificial lift systems at new and existing well locations in the BNGPA where required by reservoir and wellbore conditions. Artificial lift systems include PC pumps and pumpjacks, which would be powered by an electric motor or a natural gas-fired generator. It is estimated that 930 artificial lift systems will be required in the

BNGPA. Because of the small amount of available electrical power, approximately 80 percent of artificial lift applications (744) would have a generator as a power source. The typical generator used on pumpjacks has a 4-stroke, lean-burn, natural gas-fired engine ranging from 8.8 to 26.2 hp in size. The engines would meet emissions levels of similarly sized diesel-fired Tier 4 certified engines. The natural gas-fired generators would operate continuously and normally run at very low rpm. At 500 rpm, the estimated output for an average-size engine used in the BNGPA is 4 hp, and its gas consumption is approximately 1 mscfd. Individually these generators are very small sources of NO_x, CO, VOCs and formaldehyde. Emissions estimates for the generators were calculated following EPA's AP-42, Section 3.2, Natural Gas-fired Reciprocating Engines; and from operating parameters provided above. Emissions of NO_x, CO, VOCs and formaldehyde are estimated as 0.2, 0.1, 0.02 and 0.01 tons per year, respectively. Total field-wide emissions estimates of NO_x, CO, VOCs and formaldehyde from the proposed artificial lift systems are 117.3, 77.1, 16.3, and 7.3 tons per year, respectively. A summary of the total pollutant emissions from all proposed production sources is provided in Table 4.1-3

Table 4.1-3. Total Proposed BNGPA Emissions

Source Category	Emissions (lb/hr)				Emissions (tpy)			
	NO_x	CO	VOCs	H_2CO	NO_x	CO	VOCs	H_2CO
Compressor Stations	12.6	8.2	8.2	2.0	54.0	34.6	35.0	8.2
Artificial Lift Systems	26.8	17.6	3.7	1.7	117.3	77.1	16.3	7.3
Total Proposed	**39.4**	**25.8**	**11.9**	**3.7**	**171.3**	**111.7**	**51.3**	**15.5**

The proposed generator engines are minor emissions sources and would not be subject to MDEQ-ARMB permit review. However, prior to commencement of construction of a new or modified industrial facility, such as a compressor station, MDEQ-ARMB requires an emission source to undergo a review to ensure compliance with New Source Review permit requirements. A permit application would be required to be submitted to MDEQ-ARMB for review and approval prior to construction or operation of the proposed new facility or any modification to an existing facility. NO_x emissions from the proposed compressor stations would be the most significant emissions anticipated, and these emissions are below thresholds established in the MDEQ-ARMB modeling guidance above which dispersion modeling would be required as part of an air permit application. However these thresholds serve as a guide only, and dispersion modeling could be required upon request from MDEQ-ARMB as part of the permit application.

The EPA's SCREEN3 model was run to estimate maximum near-field concentrations of NO_2 produced from the largest proposed compressor (Ajax DPC-2803LE) in the project area. The SCREEN3 model predicted maximum one-hour and annual NO_2 impacts of 103.5 and 8.3 $\mu g/m^3$ including background concentrations, respectively. These values are well below the MAAQS/ NAAQS. Cumulative impacts from multiple compressors and artificial lift systems in the project area are also not expected to cause exceedances of any MAAQS/NAAQS since compression and artificial lift systems are spread throughout the BNGPA, and maximum pollutant impacts are localized and would occur adjacent to the compression facilities without any significant contribution from the nearest compressor engine and from artificial lift operation. All pollutant impacts from compressor station and artificial lift operation would be below ambient air quality standards and PSD increments.

The CALPUFF model was used to estimate project impacts to ambient concentrations and AQRVs at the federal PSD Class I, UL Bend Wilderness Area and the MDEQ-ARMB Class I,

Fort Peck Indian Reservation. CALPUFF was used to predict maximum NO_2 concentrations and to estimate AQRV impacts, including visibility degradation (regional haze) and atmospheric nitrogen (N) deposition at these two Class I areas. The CALPUFF analysis included modeling NO_x emissions from BNGPA sources (Table 4-1.3) combined with five years (1986-1990) of Glasgow, MT, hourly meteorological data.

The maximum modeled annual NO_2 concentrations at the PSD Class I, UL Bend Wilderness Area and MDEQ-ARMB Class I, Fort Peck Indian Reservation are 0.0004 $\mu g/m^3$ and 0.003 $\mu g/m^3$, respectively, which are well below the PSD Class I increment value for NO_2 of 2.5 $\mu g/m^3$. Although this comparison is provided, this PSD demonstration serves informational purposes only and does not constitute a regulatory PSD increment consumption analysis.

Potential visibility impacts were estimated following FLAG Guidance (FLAG, 2000) using maximum predicted 24-hour concentration impacts at the UL Bend Wilderness Area and the Fort Peck Indian Reservation combined with seasonal background visibility conditions as specified in the FLAG report. Predicted visibility impacts were compared to the BLM's 1.0 deciview (dv) change threshold. The BLM uses a 1.0 dv "just noticeable change" as a NEPA analysis threshold since any lower level would not be perceptible. Other federal agencies use a 0.5 dv change as a screening threshold for significance. The maximum predicted visibility impacts over the five-year modeling period are 0.19 deciviews (dv) at the PSD Class I UL Bend Wilderness Area, and 0.49 dv at the MDEQ-ARMB Fort Peck Indian Reservation, which are below the BLM's 1.0 dv "just-noticeable change" threshold. However, given the conservative assumptions incorporated into the visibility impact analysis, actual impacts are likely to be less.

Potential direct atmospheric N deposition impacts within the PSD Class I, UL Bend Wilderness Area and the MDEQ-ARMB Class I, Fort Peck Indian Reservation were also calculated. The maximum direct total (wet and dry) N deposition from the proposed BNGPA operations were predicted to be nearly 0.0002 kg/ha-yr at the UL Bend Wilderness Area and 0.0009 kg/ha-yr at the Fort Peck Indian Reservation. These predicted N deposition values are well below the threshold 3 kg/ha-yr for N (Fox et. al. 1989).

Cumulative Impacts

Air-pollutant emissions from the Proposed Action Alternative would occur in the BNGPA during construction and production activities within the field. Nitrogen oxides (NO_x) from natural-gas combustion sources emitted over the LOP would be the primary pollutant emitted in the field and would result in increased ambient concentrations of NO_2. The NO_x emissions from the BNGPA would combine with emissions from other regional sources to produce cumulative air-quality impacts. The increase in NO_x emissions in the BNGPA from the Proposed Action Alternative could contribute to an increase in cumulative NO_2 concentrations and AQRVs impacts, including visibility degradation (regional haze) and N deposition, at the federal PSD Class I, UL Bend Wilderness Area and the MDEQ-ARMB Class I, Fort Peck Indian Reservation. Analyses of direct project impacts to ambient NO_2 concentrations and AQRVs, including regional haze and N deposition, at these sensitive areas were predicted to be below applicable ambient air-quality standards, PSD increments, and threshold values. Therefore the expected contribution to cumulative ambient air concentrations and AQRVs including regional haze and N deposition at these distant areas is expected to be negligible. In addition the cumulative concentration impacts at locations within the BNGPA would be below ambient air-quality standards. Therefore, cumulative impacts under the Proposed Action Alternative are expected to remain in compliance with all applicable standards and not contribute significantly to any degradation of AQRVs.

4.1.3 Alternative C—Maximum Development

Direct and Indirect Impacts

Under the Maximum Development Alternative, emissions as well as their associated impacts would be expected to be slightly higher than under the Proposed Action (Alternative B). Under Alternative C, up to 964 federal, 847 private and 94 state wells would be developed over a LOP of 30-50 years. A larger number of wells and associated equipment developed over roughly the same time period as proposed for the Proposed Action would lead to a greater magnitude of overall emissions and therefore a greater impact to the ambient air quality in and around the Project Area. These impacts would not, however, be expected to cause any exceedances of any air-quality standard as impacts from construction of each well would be temporary (i.e., occurring during well or pipeline construction) and would occur in isolation, without significantly interacting with sites under concurrent construction. Production impacts would also be expected to be slightly higher from the increased traffic in the project area; however, the highest impacts would be expected from field compression, which is proposed to be the same under this alternative as in the Proposed Action. Therefore, impacts during production are expected to be below any applicable standards.

Cumulative Impacts

Air-pollutant emissions from Alternative C would occur in the BNGPA during construction and production activities within the field. Nitrogen oxides (NO_x) from natural gas combustion sources emitted over the LOP would be the primary pollutant emitted in the field and would result in increased ambient concentrations of NO_2. The NO_x emissions from the BNGPA would combine with emissions from other regional sources to produce cumulative air quality impacts. The increase in NO_x emissions in the BNGPA from Alternative C could contribute to an increase in cumulative NO_2 concentrations and AQRVs impacts, including visibility degradation (regional haze) and nitrogen deposition, at the federal PSD Class I, UL Bend Wilderness Area and the MDEQ-ARMB Class I, Fort Peck Indian Reservation. Based on analyses of the Proposed Action above, the expected contribution of Alternative C impacts to cumulative ambient air concentrations and AQRVs including regional haze and N deposition at these distant areas is expected to be negligible. In addition the cumulative concentration impacts at locations within the BNGPA would be below ambient air quality standards. Therefore, cumulative impacts under Alternative C are expected to remain in compliance with all applicable standards and not contribute significantly to any degradation of AQRVs.

4.2 CULTURAL RESOURCES

4.2.1 Alternative A—No Federal Action

Direct and Indirect Impacts

This action includes the development of 558 private and 62 state wells as well as 207.5 miles of access road and 103.75 miles of pipeline. This alternative would not affect cultural resources on federal surface or split-estate lands (private surface/federal minerals). No action requiring BLM compliance with Section 106 of NHPA would occur under this alternative. Sites and areas of Traditional Native American concern would continue to be vulnerable to impacts from development on private lands.

Cumulative Impacts

Cumulative impacts could occur to cultural resources under this alternative if cultural resources located on private lands are damaged, destroyed, or removed. The BLM would need to take into account the impacts of previous development when approving future projects on adjacent federal oil and gas leases and design projects to reduce impacts and/or develop appropriate mitigation strategies.

4.2.2 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts

This alternative includes development and infrastructure of 635 federal, 558 private and 62 state wells. In addition, 210 miles of pipeline would be required and 418.75 miles of existing or new two-tracks would be utilized. Previous investigations in the region indicate a density of 18 sites per 1,000 acres inventoried. Assuming an even distribution of sites and the employment of current archaeological inventory standards (10-acre inventory at well pads and an examination of a 100-foot-wide corridor along access routes and pipelines), these projects would potentially encounter 368 cultural sites. Of these, 159 sites are expected to occur on federal or split ownership. It is anticipated that 86 percent (137) of the sites on federal land would be prehistoric and 14 percent (22) would be historic.

This alternative has the potential for both positive and negative effects. Appropriate recording of these sites has the benefit of increasing our knowledge of cultural resources in the area. This information can increase our understanding of past activities and lifeways. Adverse effects to cultural resources occur only when the properties are eligible to the National Register of Historic Places. Both physical and visual impacts can occur to sites determined eligible under criteria A–C. Depending on the site type, impacts to Traditional Cultural Properties, sacred sites, and localities of traditional concern, such as medicinal plant-collecting areas, can also be impacted physically and/or visually. Effects to sites eligible under Criterion D tend to be only physical.

Two NRHP prehistoric-eligible sites, the Beaucoup and the Henry Smith, are located within the Milk River ACEC and are protected from future impacts. Previous investigations suggest historic sites tend to be determined eligible more often (10 percent) than the prehistoric sites (three percent). Based on these findings, it is anticipated that nine prehistoric and five historic sites in the project area will be NRHP-eligible; however, only 15 percent of the previously encountered sites have been evaluated, and the number of NRHP-eligible sites could be higher.

In most cases, wells can be moved to avoid directly affecting significant cultural sites; however, it may be difficult to maneuver long, linear facilities such as roads, pipelines, etc., around large prehistoric sites. Previous investigations have found stone-feature sites tend to be concentrated along the edges of ridges, and some of these stone-feature sites can be quite large. Finding appropriate access around these sites may not be easy.

Where adverse effects cannot be avoided, appropriate measures to mitigate the adverse effects will be negotiated between the BLM, the MT SHPO and possibly, depending upon the site, the tribes or local historical societies. Mitigating direct impacts may include a variety of strategies, including additional documentation, screening, or data recovery. If a portion of a significant property is determined to be non-contributing to the property's significance, the movement of the project to that area may also minimize impacts. Indirect effects could be minimized by soil-stabilization measures, minimizing the number of roads, and erecting protective barriers to restrict traffic in sensitive areas. Procedures are established for the treatment of unanticipated

discoveries and unmarked human remains that are not identified by a surface cultural-resource inventory.

Cumulative Impacts

Cumulative impacts could occur to cultural resources under this alternative if NRHP-eligible cultural resources are damaged, destroyed, or removed. As more sites are encountered, the potential cumulative effects increase. The BLM would take into account the impacts of previous development when approving projects on federal oil and gas leases and design projects to reduce impacts and/or develop appropriate mitigation strategies.

Traditional Cultural Properties: The Larb Hills (Saco Hills) are recognized as a traditional plant-gathering place for traditional cultural practitioners on the Fort Peck and Fort Belknap reservations and recommended NRHP-eligible as a traditional cultural property. The effects of development on the traditional cultural properties of the Saco Hills can be both beneficial and detrimental. Development would provide increased access to kinnikinnick and other ceremonial/medicinal plants. At the same time, these ground disturbances could potentially destroy important gathering locations. The BLM would work with the tribes to minimize impacts to areas with high concentrations of important traditional plants.

4.2.3 Alternative C—Maximum Development Alternative

Direct and Indirect Impacts

This alternative includes development and infrastructure of 964 federal, 847 private and 94 state wells. In addition, 636 miles of existing or new two-tracks would be utilized and 318 miles of pipeline would be required. Previous investigations in the region indicate a density of 18 sites per 1,000 acres inventoried. Assuming an even distribution of sites and the employment of current archaeological inventory standards (10-acre inventory at well pads and an examination of a 100-foot-wide corridor along access routes and pipeline corridors), these projects would potentially encounter 551 cultural sites. Of these, 242 sites are expected to occur on federal or split ownership. It is anticipated that 86 percent (n=208) of the sites on federal land or split estates will be prehistoric and 14 percent (n=34) will be historic.

This alternative has the potential for both positive and negative effects. Appropriate recording of these sites has the benefit of increasing our knowledge of cultural resources in the area. This information can increase our understanding of past activities and lifeways. Adverse effects to cultural resources occur only when the properties are eligible for the NRHP. Both physical and visual impacts could occur to sites determined eligible under criteria A–C. Depending on the site type, impacts to Traditional Cultural Properties, sacred sites, and localities of traditional concern such as medicinal plant collecting areas, can also be impacted physically and/or visually. Effects to sites eligible under Criterion D tend to be only physical.

Two NRHP-eligible prehistoric sites, the Beaucoup and the Henry Smith, are located within the Milk River ACEC and are protected from future impacts. Previous investigations suggest historic sites tend to be determined eligible more often (10 percent) than the prehistoric sites (three percent). Based on these findings, it is anticipated 14 prehistoric and eight historic sites in the project area will be NRHP-eligible; however, only 15 percent of the previously encountered sites have been evaluated, and the number of NRHP eligible sites could be higher.

In most cases, wells can be moved to avoid directly affecting significant cultural sites; however, it may be difficult to maneuver long linear facilities, such as roads, pipelines, etc., around large prehistoric sites. Previous investigations have found stone feature sites tend to concentrated

along the edges of ridges, and some of these sites can be quite large. Finding appropriate access around these sites may not be easy.

Where adverse effects cannot be avoided, appropriate measures to mitigate the adverse effects would be negotiated between the BLM, the MT SHPO and possibly (depending upon the site) the tribes or local historical societies. Mitigating direct impacts may include a variety of strategies, including additional documentation, screening, or data recovery. If a portion of a significant property is determined to be non-contributing to the property's significance, the movement of the project to that area may also minimize impacts. Indirect effects could be minimized by soil-stabilization measures, minimizing the number of roads, and erecting protective barriers to restrict traffic in sensitive areas. Procedures are established for the treatment of unanticipated discoveries and unmarked human remains that are not identified by a surface cultural-resource inventory.

Cumulative Impacts

Cumulative impacts could occur to cultural resources under this Alternative if NRHP-eligible cultural resources are damaged, destroyed, or removed. As more sites are encountered, the potential cumulative effects increase. The BLM would take into account the impacts of previous development when approving projects on federal oil and gas leases and design projects to reduce impacts and/or develop appropriate mitigation strategies.

Traditional Cultural Properties: The Larb (Saco) Hills are recognized as a traditional plant-gathering place for traditional cultural practitioners on the Fort Peck and Fort Belknap reservations and is recommended NRHP-eligible as a traditional cultural property. The effects of development upon the traditional cultural properties of the Saco Hills can be both beneficial and detrimental. Development would provide increased access to kinnikinnick and other ceremonial/medicinal plants. At the same time, these ground disturbances could potentially destroy important gathering locations. The BLM would work with the tribes to minimize impacts to areas with high concentrations of important traditional plants.

4.3 GEOLOGY, MINERALS, AND PALEONTOLOGY

4.3.1 Alternative A—No Federal Action

Direct and Indirect Impacts to the Geologic Environment

Direct and indirect impacts could occur to the geological environment due to project implementation and operation. However, because no wells or infrastructure would be approved on federal lands, such impacts under this alternative would be restricted to state and private lands.

Direct and indirect impacts to the geological environment on state and private lands as a result of natural-gas development would include damage to the surface environment such as alteration of existing local topography that causes mass movements including landslides, results in flooding, or accelerated erosion. Alternative A—No Federal Action would not contribute to increased risks of earthquakes or subsidence. Earthquake-induced ground shaking could result in damage to above-ground structures although the likelihood of earthquakes is low as indicated by the absence of recorded epicenters in the area. Site-specific dirt work completed while constructing well pads and ancillary facilities could disturb soils and underlying parent material, causing mass movements or flooding. Potential mass-movement hazards are greatest for constructions of steeper slopes in the Claggett Shale, particularly at the geological contact of

the Claggett Shale and overlying Judith River Formation. The Bowdoin area is a region of marked susceptibility for 'landsliding,' but a low level of actual incidents. The widespread presence of swelling clays in surface formations, particularly the Claggett and Bearpaw formations, is a concern for construction.

Cumulative Impacts to the Geologic Environment

Under this alternative additional state and private acreage would be developed and removed from other uses. Most surface disturbance would be temporary and reclaimed based on reclamation and mitigation measures described in the Plan of Development. However, a total of 473 acres will be removed from alternative use for the 30–50 year LOP wells until final reclamation to be completed within two to three years of plugging of the wells.

Direct and Indirect Impacts to Minerals

Under this alternative the MBOGC would approve the drilling, completion, and production of 558 private wells and 62 state wells; construction of associated infrastructure including access roads, flowlines, and power lines; reclamation of disturbed areas; application of existing water management options; and the use of meter and compressor facilities. These 620 wells would be drilled and completed in the Upper Cretaceous including, but not limited to, the Niobrara, Bowdoin (Carlile), Greenhorn, Phillips, Belle Fourche, and Mowry Formations (a/k/a Colorado Group). The average production LOP is expected to be 30–50 years with final reclamation to be completed two to three years after plugging of the wells.

This alternative would allow for recovery of gas reserves on state and private lands and would generate state and private revenue. The demand for sand and gravel may increase as demand increases for building materials for roads, well pads, and other ancillary facilities, which could lead to local depletion of these construction resources on state and private lands. Additional construction-grade material sources would likely be required in addition to those identified locally.

Cumulative Impacts to Minerals

This alternative would allow for development of gas reserves under state and private lands, but since no wells would be drilled on federal lands, no federal reserves or revenues would be produced. Natural gas reserves developed under state and private lands would eventually be depleted and some drainage and depletion could occur from federal lands by adjacent producing wells situated on state or private lands. Non-development of gas reserves under federal lands may not be the most efficient way of developing gas reserves.

Direct and Indirect Impacts to Paleontology

Construction of well pads, access roads, and production facilities, and excavation of pipeline trenches on state and private lands could result in direct impacts to fossils. Potential impacts would include damage or destruction of important fossils during construction, with subsequent loss of scientific information. Adverse indirect impacts would include damage or destruction of fossils by accelerated erosion due to surface disturbance. In addition, improved access and increased visibility may result in unauthorized fossil collection or vandalism.

Excavation could reveal fossils of scientific significance that would otherwise have remained buried and unavailable for scientific study. If newly discovered fossils are properly collected and catalogued into the collections of a museum repository along with associated geologic data, the data would be available for future scientific study. In this way, significant positive consequences

could result from the unanticipated discovery of previously unknown, scientifically significant fossils.

The magnitude of impacts associated with the destruction of fossil resources would be reduced by the implementation of paleontological resource mitigation measures described in section **3.3.5, Paleontological Resources**.

Cumulative Impacts to Paleontology

Cumulative impacts could occur to paleontological resources under this alternative if fossil resources located on state or private lands are damaged, destroyed or removed. The BLM would need to take into account the impacts of previous development when approving future projects on adjacent federal oil and gas leases and design projects to reduce impacts and/or develop appropriate mitigation strategies.

4.3.2 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts to the Geologic Environment

The Proposed Action includes drilling, completion, and production of 558 private wells and 62 state wells; construction of associated infrastructure including access roads, flowlines, and power lines; reclamation of disturbed areas; application of existing water management options; and the use of meter and compressor facilities. These 1,255 wells would be drilled and completed in the Upper Cretaceous including, but not limited to the Niobrara, Bowdoin (Carlile), Greenhorn, Phillips, Belle Fourche, and Mowry Formations (a/k/a Colorado Group). The average production LOP is expected to be 30–50 years with final reclamation to be completed two to three years after plugging of the wells.

Direct and indirect impacts would be similar to those discussed for Alternative A—No Federal Action, except that the impacts noted would be extended to federal lands, thereby affecting a greater area.

Cumulative Impacts to the Geological Environment

Under this alternative additional federal, state, and private land would be developed and removed from other uses. Most surface disturbance would be temporary and reclaimed based on reclamation and mitigation measures described in the Plan of Development. However, a total of 945 acres would be removed from alternative use for the 30–50 year LOP until final reclamation to be completed within two to three years of plugging of the wells.

Direct and Indirect Impacts to Minerals

Direct and indirect impacts would be similar to those discussed for Alternative A—No Federal Action, except that the impacts noted would be extended to federal lands, thereby affecting a greater area.

Cumulative Impacts to Minerals

Natural gas reserves developed under federal, state and private lands would eventually be depleted. Recovery of gas reserves would generate federal, state, and private revenues. Development of federal lands may be the most efficient way to develop gas reserves, and drainage would not occur from federal lands into adjacent producing wells situated on state or private lands.

Direct and Indirect Impacts to Paleontology

Direct and indirect impacts would be similar to those discussed for Alternative A—No Federal Action, except that the impacts noted would extend to federal lands, thereby affecting a greater area.

Cumulative Impacts to Paleontology

Cumulative impacts could occur to paleontological resources under this alternative should fossil resources located on federal, state, or private lands be damaged, destroyed, or removed. As for Alternative A, the BLM would need to take into account the impacts of previous development when approving future projects on adjacent federal oil and gas leases and design projects to reduce impacts and/or develop appropriate mitigation strategies.

4.3.3 Alternative C—Maximum Development Alternative

Direct and Indirect Impacts to the Geologic Environment

Direct and indirect impacts would be similar to those discussed for the other alternatives except that the impacts noted would be extended to a greater number of wells and larger number of associated ancillary facilities on federal lands, thereby affecting a greater area.

Cumulative Impacts to the Geologic Environment

This alternative includes the maximum development of federal, state, and private acreage. Most surface disturbance would be temporary and reclaimed based on reclamation and mitigation measures described in the Plan of Development. However, a total of 1,428 acres would be removed from alternative use for the 30–50 year LOP until final reclamation to be completed within two to three years of plugging of the wells.

Direct and Indirect Impacts to Minerals

Alternative C includes drilling, completion, and production of 558 private wells and 62 state wells; construction of associated infrastructure including access roads, flowlines, and power lines; reclamation of disturbed areas; application of existing water management options; and the use of meter and compressor facilities.. These 1,905 wells would be drilled and completed in the Upper Cretaceous including, but not limited to the Niobrara, Bowdoin (Carlile), Greenhorn, Phillips, Belle Fourche, and Mowry Formations (a/k/a Colorado Group).

Direct and indirect impacts would be similar to those discussed for the other alternatives except that the impacts noted would be extended to a greater number of wells and larger number of associated ancillary facilities on federal lands, thereby affecting a greater area.

Cumulative Impacts to Minerals

Cumulative effects would be similar to those discussed for Alternatives A and B, except that the additional wells under this alternative could lead to faster depletion of minerals and would increase the level of overall disturbance compared to these alternatives.

Direct and Indirect Impacts to Paleontology

Direct and indirect impacts would be similar to those discussed for Alternative B, except that the impacts noted would extend to a greater number of wells and ancillary infrastructure on federal lands, thereby affecting a greater area.

Cumulative Impacts to Paleontology

Cumulative impacts could occur to paleontological resources under this alternative should fossil resources located on federal, state, or private lands be damaged, destroyed, or removed. As for Alternative A and B, the BLM would need to take into account the impacts of previous development when approving future projects on adjacent federal oil and gas leases and design projects to reduce impacts and/or develop appropriate mitigation strategies.

4.4 WASTES, HAZARDOUS OR SOLID

4.4.1 Alternative A—No Federal Action

Direct and Indirect Impacts

Under this alternative, there would be no additional impacts attributable to BLM-managed mineral leases or surface in the BNGPA. The BLM would not approve activities related to federal minerals, or federal surface resulting in the construction of new federal wells or associated infrastructure on BLM-administered lands. Existing production operations on federally managed minerals and lands within the BNGPA would continue. This alternative limits additional natural-gas production and development to private and state lands and minerals only.

Direct effects of this alternative include the MBOGC approving the drilling, completion, and production of an additional 558 private wells and 62 state wells. In addition to the wells, the associated infrastructure would be constructed including access roads, flowlines, and power lines. Disturbed areas not needed for production operations would be reclaimed following construction. Each well site would include an earthen mud pit and a reserve pit for drilling mud and cuttings. During production operations a pit would be constructed for produced-water disposal. The management of drilling and completion fluids, produced water and solid wastes as well as emergency-response activities would continue as described in **Section 3**, **Affected Environment**.

Each drilling project would require the use of hazardous materials such as drilling-mud components, well-completion chemicals, cement, corrosion inhibitors, glycol, antifreeze, new and used lube oils, paints, gasoline, and diesel fuel. Limited volumes of these materials would be stored and used in various locations within the field during different stages of construction, development, and production. Due to the shallow nature of the geologic target, the small size of the drilling locations and rigs being used, and the short duration of each drilling operation (three days), it is not anticipated that the volume of any single material on hand at any one time would exceed the threshold planning quantity (TPQ) of 10,000 pounds for hazardous materials, which is the notification requirement of Title III of the Superfund Amendments and Reauthorization Act (SARA). It is not expected that any extremely hazardous substances (EHSs), as defined in SARA, would be used in the operations. The BNGPA Operators are required to provide inventories and locational information relative to on-site hazardous materials that exceed the TPQ to state and local emergency responders for use in case of emergency. It is anticipated that the drilling and completion contractors operating in the field would stage their equipment elsewhere and would bring to the field locations only those materials needed for the specific operation being completed. Due to the simple nature of these field operations, there are no field offices or storage yards for the support of production operations located in the BNGPA, so storage of hazardous materials is not anticipated.

Receptacles would be provided for collection of wastes generated during construction and drilling operations. Trash generated during production and gas transmission operations would

be collected in bags or containers located in the service vehicle. All collected trash/solid wastes would be disposed at third-party facilities permitted through the County Sanitarian.

Wastes associated with drilling, completion, and production of wells, such as drilling muds and cuttings and completion fluids, would be managed on-site, recycled, or diposed of through state-permitted third-party contractors. Water-based drilling mud and completion fluids are recycled to minimize the need for disposal. If exotic or oil-based muds were approved by MBOGC, the use of a closed mud system with above-ground mud tanks would be required to manage the material. Exotic muds would be removed and reused to the extent possible, then hauled to a permitted, third-party facility for disposal. Typically, reserve pit contents are removed shortly after the completion of drilling and transferred to another drilling location for use. Mud no longer suitable for drilling due to the cuttings content is transferred to local land-owners for use in sealing stock ponds and reservoirs. The pit would then be backfilled. Negligible amounts of mud may be buried in the process of backfilling the pit. Reserve pits are generally closed within a year of completing drilling operations. In the unlikely event that a pit is not closed at the end of the year, it would be managed by removing the remaining fluids and either reusing them at another well location or hauling them to a permitted third-party disposal facility. Following reserve- and mud-pit closure, the site would be minimized and a produced-water pit constructed. Interim reclamation would be implemented (see **Appendix D—Reclamation**). Completion and flare pits would not be used on these well sites.

Produced water would be separated from the natural gas in equipment located in a 'well house' at each well site. Separated water would be discharged to the permitted on-site pit when less than 5 BWPD is produced. Water volumes greater than 5 BWPD would be contained on-site until transported within the field to well sites where lesser volumes of produced water are produced. To manage water from wells producing more than 5 BWPD, Fidelity E&P and Noble have each permitted and constructed a centrally located produced-water disposal facility with a lined evaporation pit.

The production from a portion of the existing wells within the BNGPA will be enhanced by the installation of artificial lift pumping systems, as opposed to the current production method which relies on the energy of the reservoir to bring the natural gas to the surface. It is expected that artificial lift systems, PC, pump jack rod and pump systems, or an alternate technology, will increase the volume of water produced as well as the volume of gas. Small unlined pits at individual well sites are currently designed and permitted to receive less than 5 BWPD. As water production increases, the required disposal pit size may increase and the need for enhanced protection of the shallow ground water resource may be realized. BLM has the authority to require lined pits with leak-detection systems at these well sites producing more than 5 BWPD. As an alternative, some operators have permitted large, lined, centralized evaporation ponds for managing these increased water volumes. Additional facilities of this type may be needed in the future.

Migratory-bird deterrent devices are generally not used at the produced-water disposal pits within the Bowdoin project area as accumulations of hydrocarbon do not occur. The BLM/FS Gold Book (2006) requires such mitigation in the event that the pits "present a potential hazard to humans, livestock, wildlife, and other resources." The Master APD for the field area states that BLM "may require that the pit be designed or open vessel be covered to deter the entry of birds in any facility associated with drilling, testing, completing, or production of this well. Fencing, screening and netting of pits may be required as a means to prevent the entry of migratory birds if oil is left in pits or open vessels after the cessation of drilling or completion of

operations, if water disposal pits consistently receive oil, or if pits or open vessels are used repeatedly for emergency situations which result in the accumulation of oil."

The BLM-required hazardous materials Inventory for the BNGPA operations is located in **Appendix C**.

Indirect effects of this alternative would include the continuation of the production of the existing federal, fee, and state wells in the BNGPA and the continuation of environmental programs as described in **Section 3**, **Affected Environment** and in the direct impacts described above.

4.4.2 Alternative B—Proposed Action with Additional Mitigation

Under this alternative, there would be additional impacts attributable to BLM-managed mineral leases or surface in the BNGPA. The BLM would approve activities related to federal minerals, or federal surface resulting in the construction of new federal wells or associated infrastructure on BLM-administered lands. In addition to the additional drilling and production activity, the existing production operations in the BNGPA would continue.

The direct effects of Alternative B include the drilling, completion, and production of 1,255 wells, of which there are 635 federal, 558 private, and 62 state wells. In addition to the wells, the associated infrastructure would be constructed including access roads, flowlines, and power lines. Disturbed areas not needed for production operations would be reclaimed following construction. These 1,255 wells would be drilled and completed across the BNGPA; of this total, 435 (215 federal, 22 state, and 198 private) would be replacement wells. As with Alternative A, the installation of artificial lift production systems is expected. The increased volume of produced water will require the installation of larger, possibly lined, disposal pits or centralized evaporation ponds. The management of hazardous materials, drilling and completion fluids, and produced water would be consistent with that described in Alternative A and would occur on state, fee and federal lands, and mineral leases throughout the BNGPA.

The direct impacts of implementing Alternative B would be the same as those described in Alternative A but would include the construction, drilling, completion, and operation of 635 additional wells, which would add to the volumes of waste material, including produced water, generated and managed in the project area.

Mitigation: BNGPA Operators propose to implement the BMPs committed to in Alternative B as well as some additional measures in order to minimize impacts due to waste generation. These measures are listed below.

1. BNGPA Operators would collect and properly dispose of any solid or liquid wastes generated by the Proposed Action in accordance with the applicable state and federal regulations and as permitted by the BLM, MBOGC, and MDEQ.

    - Recycle drilling mud, to the extent feasible.
    - Continue the practice of providing drilling mud to private land-owners for use as stock-pond sealant.
    - Recycle completion fluids, to the extent feasible.
    - Provide receptacles for management of trash and construction debris generated during construction and operations.

- Provide toilet facilities for field operations.
- Use, store, transport, and dispose of hazardous materials in accordance with applicable state and federal laws.
- Investigate the feasibility of using produced water in well drilling and completion processes.
- Investigate the concept of produced-water gathering and centralized disposal ponds as an alternative to individual well site disposal operations.

2. Gas-transmission system Operators would implement the following mitigation measures:

- Manage gas-transmission system equipment maintenance fluids such as used oil and antifreeze through third-party or in-house recyclers.
- Implement the system-wide SPCC, expanded when necessary to cover new facilities, as required by the Clean Water Act (40 CFR 112.7).
- Recycle methanol to minimize the need for disposal.
- Provide portable toilets for field operations.

Indirect effects of implementing Alternative B would include the continuation of the production of existing federal, fee, and state wells in the BNGPA and the continuation of the environmental compliance programs as described in **Section 3**, **Affected Environment** and in Direct Impacts, above.

4.4.3 Alternative C—Maximum Development Alternative

Direct and Indirect Impacts

Under this alternative, there would be additional impacts attributable to the drilling of 1,905 additional state, fee, and federal wells in the BNGPA. The BLM would approve activities related to federal minerals, or federal surface resulting in the construction of new federal wells or associated infrastructure on BLM-administered lands. In addition to the additional drilling and production activity, the existing production operations in the BNGPA would continue.

The direct impacts of implementing the Maximum Development Alternative include the drilling, completion, and production of 1,905 wells, of which there are 964 federal, 847 private, and 94 state wells. In addition to the wells, the associated infrastructure would be constructed including access roads, flowlines, and power lines. Disturbed areas not needed for production operations would be reclaimed following construction. These 1,905 wells would be drilled and completed across the BNGPA; of this total, 660 (326 federal, 33 state, and 301 private) would be replacements. The number of wells produced using artificial lift systems will be greater than that realized in Alternatives A or B. The management of hazardous materials, drilling and completion fluids, and produced water would be consistent with that described in Alternative B and would occur on state, fee, and federal lands and mineral leases throughout the BNGPA.

The direct effects of implementing Alternative C, the Maximum Development Alternative, would be the same as those described in Alternative A but would include the construction, drilling, completion, and operation of 650 more wells than Alternative B. Alternative C would add to the volumes of waste material, including produced water, generated and managed in the project

area; these materials would be managed using the same mitigation measures as discussed under Alternative B.

Indirect effects of implementing Alternative C would include the continuation of the production of existing federal, fee, and state wells in the BNGPA and the continuation of the environmental compliance programs as described in **Section 3, Affected Environment** and in direct impacts, above.

Cumulative Impacts

All alternatives analyzed would result in an increase in drilling and production wastes buried in the BNGPA, but Alternative A—No Federal Action would result in no additional drilling taking place on federally managed lands or minerals; therefore, under Alternative A additional federal wells would not contribute to drilling and production wastes disposed within the project area. Drilling cuttings would continue to be transferred off-site for stock-pond sealant with some limited burial on-site. Produced water would be disposed in on-site evaporation pits at all new wells drilled and at all existing wells in the project area. Regardless of the alternative selected, over time the volume of water produced in the BNGPA is expected to increase substantially, requiring an enhanced ability to manage the water over the life of the project without threatening the shallow ground water resource. All other wastes generated would be considered non-hazardous and disposed at permitted third-party facilities appropriate to the specific waste stream. The cumulative impact of waste generation and management by the BNGPA Operators would have a negligible impact on the project area under any alternative.

4.5 WATER RESOURCES, SURFACE AND GROUND

4.5.1 Alternative A—No Federal Action

Direct and Indirect Impacts to Surface Water

Under this alternative, disturbance would result from developing 558 private wells and 62 state wells along with associated infrastructure consisting of access roads, flowlines, power lines, water-handling facilities, and metering and compression facilities.

Potential impacts that could occur to the surface-water system due to Alternative A include increased surface water runoff and off-site sedimentation due to soil disturbance (section **4.9, Soils**), water-quality impairment of surface waters, and stream-channel morphology changes due to road and pipeline crossings. The magnitude of the impacts to surface-water resources would depend on the proximity of the disturbance to a drainage channel, slope aspect and gradient, degree and area of soil disturbance, soil character, duration of construction activities, and the timely implementation and success/failure of mitigation measures. Impacts would likely be greatest shortly after the start of construction activities and would decrease in time due to stabilization, reclamation, and revegetation efforts. Construction activities would occur over a 10–15 year period; therefore, the majority of the disturbance would be of low intensity over a relatively long duration. During construction, petroleum products and other chemicals could be accidentally spilled resulting in surface-water contamination. Similarly, reserve and evaporative pits could leak if liners were punctured or no liners were installed, resulting in surface-water degradation.

The primary impact of Alternative A on surface-water resources would be the potential for increasing surface runoff, erosion, and off-site sedimentation that could cause channel instability and degradation of surface-water quality. Total new surface disturbance resulting from

Alternative A would be 1,045 acres (approximately 0.13 percent of the total BNGPA, which encompasses some 813,000 acres). This total would include 322 acres of new surface disturbance from well locations (including on-site gathering, measurement, and compressor facilities), 302 acres of new roads or upgrades of existing roads, 377 acres of new pipeline construction, and up to 44 acres of evaporative water-disposal pits. The construction disturbance would not be uniformly distributed across the project area, but rather, project facilities would be located where the efficiency and feasibility of extracting the natural gas would be the highest.

The Alternative A project area would encompass existing and proposed gas-production facilities and infrastructure currently accessed by existing and proposed roads. The existing road network was developed to access prior and ongoing drilling and production activities, as well as other land-use activities. All new access roads would be two-track roads constructed specifically for natural-gas development. Alternative A assumes the construction of no more than 620 wells and associated roads and pipelines. Roads would be designed to minimize disturbance, and all surface disturbance would be contained within the road right-of-way to the extent feasible. In the event drilling is non-productive, all disturbed areas, including the well site and new access road, would be reclaimed to the approximate landform that existed prior to construction. If drilling is productive, all access roads to the well site would remain in place for well-servicing activities. Partial reclamation would be completed on segments of the well pad and access road right-of-way that are no longer needed. Under Alternative A, the BNGPA would have a maximum of 207.5 miles (301.8 acres) of new roads or upgrades of existing roads, and 207.5 miles (103.75 miles of 5-foot width and 103.75 miles of 25-foot width, entailing 377.3 acres) of new gas and water-collection lines would be installed.

No road or pipeline crossings of perennial waters are anticipated; use of existing road crossings of perennial streams would be continued. If necessary, pipeline crossings of perennial waterways would be bored.

Impacts to ephemeral and intermittent streams would be limited to temporary alteration of the beds and banks, and possibly increased sediment loads during the initial storm events following construction. Pipeline installation at the surface-water crossings should not permanently alter stream morphology or hydraulic capacity if constructed and maintained according to the standards of construction required.

Numerous prairie pothole or other wetland areas are found primarily within the Whitewater Watershed. Potential impacts to prairie potholes or other wetland areas include the loss of supporting hydrology via (1) the compaction of hydric soils during construction, and (2) increased runoff and sedimentation due to vegetation removal. Pipeline corridors within the BNGPA would typically avoid wetland habitat. Potholes may have pipelines “knifed-in” during extremely dry conditions. Fill placement under the U.S. Army Corps of Engineers (COE) jurisdiction is not anticipated. If necessary, the placement of fill material in jurisdictional wetlands or other Waters of the U.S. would be regulated under Section 404 of the Clean Water Act. The COE would be consulted, and appropriate permitting and subsequent conditions would be completed before any fill placement in jurisdictional wetland areas.

Impairments to surface-water quality could occur from leaks of wellheads, compressor stations, and excursions from produced-water pits. Leaching of hydrocarbon contaminants from impacted soils near these facilities would also be sources of potential contamination. The severity of potential impacts would depend upon the chemical released, the quantity released, and the proximity of the release to surface waters.

Water would be used by the project during construction activities for drilling, dust control, and hydrostatic testing of the pipelines. Drilling each well would require 5,000 barrels (210,000 gallons; 0.64 acre-feet) of water. Fresh water used for drilling operations would be purchased from existing commercial water sources and is not usually withdrawn from on-site streams, rivers, or aquifers.

The amount of produced water within the BNGPA would average less than five BWPD for wells without artificial lift. Wells equipped with artificial lift may initially produce up to15 bbl/day/well, with this rate of production declining approximately 5–8 percent per year. Regardless of the lift mechanism, the disposal of produced water under all alternatives would utilize evaporation pits at each well site. Approximately 70 percent of the new locations would have a 40 x 40-foot evaporation pit, and 30 percent of the locations would have a 60 x 60-foot evaporation pit. A central disposal facility would service those sites that produce water in excess of the evaporative capacity of the wellsite pits. The use of evaporation ponds would not affect the project area's surface-water resources.

Direct and Indirect Impacts to Groundwater

Potential impacts to groundwater resources include contamination with produced water, drilling mud, or hydrocarbons resulting from leaks or spills from drilling rigs or compressor sites. Soil contamination near these sites, if not remedied quickly, could migrate into underlying, shallow alluvial groundwater and introduce hydrocarbon contaminants and other dissolved inorganic constituents into the groundwater. Irrigation and stock watering are the primary uses for the alluvial groundwater in the BNGPA, but uses also include domestic, commercial, municipal and wildlife/waterfowl. Water for domestic uses typically requires treatment before use, given relatively high total dissolved-solids concentrations. Given that the location of most project facilities is in the upland areas where no alluvium is present, the probability for contamination of alluvial aquifers in the valley bottoms is relatively low.

At each well pad location, water and muds used for drilling would be stored in reserve pits, and while the majority of pits would be lined, some pits in areas with relatively impermeable soils (i.e., clay) would be unlined; therefore, some potential for contamination of shallow aquifers from drilling fluids exists. However, the potential for aquifer contamination from surface infiltration from evaporation ponds or reserve pits would be held to insignificant levels by lining pits in areas where soils are incapable of containing fluids.

Potential impacts to deeper aquifers include cross-aquifer mixing through the wellbore. However, the potential for these impacts is insignificant as all wells would be cased and cemented to depths below accessible freshwater zones pursuant to MBOGC rules and regulations. All wells also would be constructed according to relevant MBOGC and MDEQ regulations to prevent cross-aquifer contamination. There would be minor potential for commingling of waters during well construction if proper well drilling procedures and completions techniques are employed.

As discussed above, produced water is minimal (less than 5 BWPD) for wells without artificial lift. For wells with artificial lift, per-well production may be up to 15 BWPD. The disposal of produced water under all alternatives would utilize evaporation ponds at each wellsite. The size and number of evaporation pits is not anticipated to increase with artificial lift, although water-hauling to centralized facilities would increase. Approximately 25 percent of the evaporation pits may require periodic water-hauling because of fluctuations in water production. In these cases, the water would be hauled to a permitted disposal site. The potential for aquifer contamination from surface infiltration from evaporation ponds would be held to insignificant levels by lining

pits in areas where soils are incapable of containing fluids. The use of evaporation ponds, constructed and maintained to standard specifications as required by MBOGC, would not affect groundwater resources in the BNGPA.

Cumulative Impacts to Surface Water and Groundwater

Since no surface water is proposed for use during the development of this project, and construction and operation guidelines pertinent to water quality concerns would minimize effects to water resources, there would be no increase in cumulative impacts to surface-water quality or quantity resulting from this project.

The cumulative volume of groundwater anticipated for consumption from this and other projects in combination would be negligible compared with existing regional water supplies. Cumulative impacts to groundwater quantity are expected to be insignificant.

All proposed regional oil and gas development projects would use mitigating techniques contained within existing federal, state, and local water-quality laws as described in **Section 2**, **Alternatives Including the Proposed Action**, to prevent groundwater pollution. Therefore, cumulative impacts to groundwater quality would be expected to be insignificant.

4.5.2 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts to Surface Water and Groundwater

Potential direct and indirect impacts to surface water and groundwater quality and quantity under the Proposed Action would be the same as those identified in Alternative A. The difference between Alternative A and Alternative B is the addition of 635 federal wells to the project. The addition of the federal wells could extend the construction period by approximately five years. These additional wells require BLM construction-standard specifications and oversight, monitoring, and additional mitigations, and protection of riparian areas in accordance with the JVPRMP.

As with Alternative A, the primary impact of Alternative B on surface-water resources would be the potential for increasing surface runoff, erosion, and off-site sedimentation that could cause channel instability and degradation of surface-water quality. Total new surface disturbance resulting from Alternative B would be 2,013 acres (approximately 0.26 percent of the total BNGPA).

Cumulative Impacts to Surface Water and Groundwater

The cumulative effects to surface-water and groundwater resources would be the same as in Alternative A.

4.5.3 Alternative C—Maximum Development Alternative

Direct and Indirect Impacts to Surface Water and Groundwater

Potential direct and indirect impacts to surface-water and groundwater quality and quantity under Alternative C would be the similar to those identified in Alternatives A and B. The difference between Alternative B (Proposed Action) and Alternative C is the addition of 329 federal and 289 fee wells to the project, resulting in the maximum development scenario. The additional wells could extend the construction period approximately five years over Alternative A (similar to Alternative B). These additional wells would require BLM construction-standard

specifications and oversight, monitoring, and additional mitigations, and protection of riparian areas in accordance with the JVPRMP.

Total new surface disturbance resulting from Alternative C would be 3,188 acres (approximately 0.39 percent of the total BNGPA). Wells proposed on private, state, and federal lands for this alternative would not significantly affect water resources assuming adherence to federal, state, and local water-quality laws, and applicant-committed mitigations as described in Alternative B.

Cumulative Impacts to Surface Water and Groundwater

The cumulative effects to surface water and groundwater resources would be the same as for Alternative A—No Federal Action.

4.6 LIVESTOCK GRAZING

4.6.1 Alternative A—No Federal Action

Direct and Indirect Impacts

Project-related disturbance from drilling and construction of access roads, pipeline corridors, and compressor sites initially would remove approximately 1,312 acres of vegetation from the range resource. Because of the large number of individual allotments and the yearly climate-driven fluctuations in annual herbage production, a constant number (stocking ratio) was derived to reflect the average potential impact to the range resource for all alternatives. Based on a review of grazing permits in the project area, it was decided that 7 acres/AUM is a realistic baseline stocking-ratio figure; however, it has been shown in the Central Great Plains that 30–50 acres/AUM may be required following a drought.

Using the 7 acres/AUM stocking-ratio number, the loss of AUMs related to 1,312 acres of vegetation disturbance would be about 187 AUMs with the implementation of Alternative A following successful reclamation. It is anticipated that approximately 624 acres of vegetation would remain disturbed during the production phase of the project, resulting in a long-term loss of about 89 AUMs for this Alternative.

Cumulative Impacts

Implementation of Alternative A would result in both short- and long-term impacts to the grazing resource. Removal of vegetation and disturbance of soils during construction would create favorable sites for invasive, non-native plant species that could present long-term problems if not properly managed. Implementation of Alternative A would have a cumulative impact on vegetation and livestock AUMs; however, the amount would be less than the amount disturbed by either Alternative B (178 AUMs) or Alternative C (270 AUMs). Cumulative impacts would be minimized by employing Gold Book standards for the proper handling of topsoil and spoil, erosion control, preventative and remedial weed-management techniques, and successful reestablishment of native vegetation.

4.6.2 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts

Implementation of Alternative B would result in a total initial vegetation disturbance of approximately 2,646 acres for a loss of approximately 378 AUMs. Potential impacts to vegetation on state and private lands would essentially remain the same as Alternative A. The

majority of additional disturbance under the Proposed Action would occur on federal lands. It is anticipated that approximately 1,249 acres of vegetation would remain disturbed during the production phase of the project resulting in a long-term loss of approximately 178 AUMs on the - project area.

Cumulative Impacts

Cumulative impacts associated with the implementation of the Proposed Action would be similar to those described for Alternative A. Implementation of the Proposed Action would have a cumulative impact on vegetation and livestock AUMs (178 AUMs), however, these impacts would be greater than Alternative A (89 AUMs) and less than Alternative C (270 AUMs). Cumulative impacts would be minimized by employing Gold Book standards for the proper handling of topsoil and spoil, erosion control, preventative and remedial weed-management techniques, and successful reestablishment of native vegetation.

4.6.3 Alternative C—Maximum Development Alternative

Direct and Indirect Impacts

Disturbance caused from drilling and construction of access roads, pipeline corridors, and compressor sites due to implementation of Alternative C would remove approximately 3,998 acres of vegetation from the project area, resulting in an initial loss of approximately 571 AUMs. It is anticipated that approximately 1,890 aces of vegetation would remain disturbed during the production phase of the project, resulting in a long-term loss of about 270 AUMs. Potential cumulative impacts to vegetation and livestock AUMs under Alternative C (270 AUMs) would be greater than those described under Alternative A (89 AUMs) and B (178 AUMs). Additional disturbance under Alternative C would increase and occur proportionately on federal, state, and private lands in comparison to impacts discussed for the Proposed Action. However, not all disturbances would impact rangeland but would be located in cropland, recreational areas, and other sites not associated with the rangeland resource.

Cumulative Impacts

Potential cumulative impacts to the range resource due to Alternative C would be similar to those described for Alternative A. Implementation of Alternative C would have a cumulative impact on vegetation resulting in a long-term loss of 270 AUMs, compared to 89 AUMs lost with implementation of Alternative A, and 178 AUMs for the Proposed Action. Cumulative impacts would be minimized by employing Gold Book standards for the proper handling of topsoil and spoil, erosion control, preventative and remedial weed-management techniques, and successful reestablishment of native vegetation for any additional project in the area for the reasonably foreseeable future.

4.7 RECREATION AND VISUAL RESOURCES

4.7.1 Recreation

4.7.1.1 Alternative A—No Federal Action

Direct and Indirect Impacts

Drilling and operations under Alternative A may coincide with recreational use in the project area. Whenever and wherever this occurs, the setting for recreational use could change

temporarily because of human activity and vehicle traffic, structures added to the landscape, and noise events associated with the alternative. BLM would not have jurisdiction over the state and fee lands developed under Alternative A.

Drilling occurring from July through November poses the higher likelihood of affecting recreation in the project area. The drilling season would overlap popular hunting seasons for big game, pheasant and other upland birds, and waterfowl. Effects to hunting would be scattered, temporary, and occasional. Drilling would occur on private and state lands scattered around the extensive project area at the rate of about 12 wells per month using one rig active at the site for two days, followed by completion activities alternating with periods of inactivity over the next two months.

A concentration of private land somewhat more likely to see drilling activity lies along the Milk River. This area is hunted during the early and general season for whitetail deer and pheasant. The pattern of existing well development indicates that this part of the project area may see replacement and new drilling under Alternative A. Private land in this area is hunted by direct permission of the land-owner, through the state's Block Management Area program (which compensates land-owners for public use), and through commercial outfitters. Several outfitters headquartered in Malta and Glasgow advertise the Milk River for hunting.

If the Cole and S.E. Nelson compressors are built as indicated in Table 2.2-4 on private land, two sources of noise may be located one-half mile or more from the BOR recreation area at Nelson Reservoir and as little as one-quarter mile from the Montana FWP's Cole Ponds FAS.

The use of artificial lift equipment as described in Chapter 2 would potentially introduce noise sources near areas of recreational use at Nelson Reservoir and at the Montana FWP's Cole Ponds FAS. Areas most sensitive to noise would be the developed recreation sites and cabin sites around Nelson Reservoir.

Seven of 10 of new and replacement wells developed under the alternative would likely use artificial lift, as implied by data in Table 2.2-4. The potential for noise exposure in or near recreation areas would depend on an Operator's decision whether to use artificial lift at a given well location, what type of equipment to install, and where to locate artificial lift equipment at the well location. The sound level experienced at a given recreational site also would depend on these Operator decisions. Noise exposure from artificial lift equipment potentially would last the life of the project.

Installing noise-reducing types of artificial lift equipment would lower the potential for impacts to recreation. Three noise-reducing options described in Chapter 2 in order of higher noise output are PC pumps with electrical power, generator-powered PC pumps with a "quiet package" or increased muffling, and engine-powered PJ units with a "hospital-grade" muffler or equivalent. The anticipated sound levels of options for artificial lift equipment are presented in Chapter 2.

Mitigation

To minimize the potential for noise impacts to recreational activity at developed recreation sites, Operators would use PC pumps with electrical power within 1/4 mile of developed recreation and cabin sites at Nelson Reservoir and would use one of the three types of noise reducing equipment from 1/4 to within 1/2 mile of these sites.

Cumulative Impacts

The short-term disturbances to recreation resources under Alternative A are not expected to contribute to the long-term cumulative impacts on the area.

Overall, there are no long-term or far-reaching impacts on recreation by project activities associated with this field-development project under Alternative A. Activities have the potential to temporarily displace some recreationists; however, return to pre-disturbance activity patterns is expected to occur rapidly once construction is complete. Long-term facilities would be located in areas of low recreation potential or areas already developed. Noise sources like compressors and artificial-lift equipment that may be placed near recreation sites such as Nelson Reservoir and the Montana FWP's Cole Ponds FAS would remain for the long term. Roughly three in 10 of the cumulative wells in the field would use artificial lift after the new and replacement wells are developed under Alternative A.

4.7.1.2 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts

Drilling and operations under Alternative B may coincide with recreational use in the project area. Whenever and wherever this occurs the setting for recreational use could change temporarily because of human activity and vehicle traffic, structures added to the landscape, and noise events associated with the alternative. BLM would have jurisdiction over the federal wells developed under Alternative B.

Drilling occurring from July through November poses the higher likelihood of affecting recreation in the project area. The drilling season would overlap popular hunting seasons for big game, pheasant and other upland birds, and waterfowl. Effects to hunting would be scattered, temporary, and occasional because of the character of drilling activity proposed for Alternative B. Drilling would occur around the extensive project area at the rate of about 24 wells per month using two rigs.

Impacts to recreation from drilling wells on private and state land and construction of related facilities, such as new or additional compressors, would potentially occur as described under Alternative A.

Previous well-development patterns and the distribution of land according to surface ownership indicate that new federal wells proposed under Alternative B and their impacts would more likely occur in the northern third of the project area (Figure 1.1-1). Habitat found on federal land suggests that impacts to hunting in this part of the project area would more likely affect mule-deer and antelope hunting, with some effect to upland bird and waterfowl hunting and fishing possible at and near small reservoirs like Compton, PR 22, and PR 54.

Under Alternative B the replacement drilling of federal wells and its impact, as well as the impact of new wells on previously undrilled quarter-sections, would occur in areas where federal ownership has already been developed. If drilling occurs on federal land near Nelson Reservoir and parts of the Bowdoin NWR complex, all of which are located in the southeastern part of the project area, hunting seasons for a range of game species would be affected during the overlap with the drilling season. Recreational wildlife observation in the area, use of the BOR campground at Nelson Reservoir, and use of cabin sites at Nelson Reservoir also could experience effects from well development activity during the drilling season.

The use of artificial lift equipment as described in Chapter 2 would potentially introduce noise sources in or near areas of recreational use at Nelson Reservoir and at the Montana FWP's Cole Ponds FAS. Areas most sensitive to noise would be the developed recreation sites and cabin sites around Nelson Reservoir. The potential for noise effects would be greater under Alternative B because roughly twice as many new and replacement wells would be drilled under Alternative B as under Alternative A. The potential would also be greater because public land within the Nelson Reservoir recreation area is included in under Alternative B, so wells that may be developed within the recreation area are potentially closer to developed recreation sites and cabin sites.

Seven of 10 of new and replacement wells developed under the alternative would likely use artificial lift, as implied by data in Table 2.2-4. The potential for noise exposure in or near recreation areas would depend on an Operator's decision whether to use artificial lift at a given well location, what type of equipment to install, and where to place the artificial lift equipment at the well location. The sound level experienced at a given recreational site also would depend on these Operator decisions. Noise exposure from artificial lift equipment potentially would last the life of the project.

Installing noise-reducing types of artificial lift equipment would lower the potential for noise impacts to recreation. Alternative B includes the same options for artificial lift as Alternative A, and the quieter options for the equipment are also as described under Alternative A.

Mitigation

To minimize the potential for noise impacts near developed recreation sites under Alternative B, Operators would apply the noise mitigations described under Alternative A.

Cumulative Impacts

The short-term disturbances to recreation resources under Alternative B are not expected to contribute to the long-term cumulative impacts on the area.

Overall, there are no long-term or far-reaching impacts on recreation by project activities associated with this field development project under Alternative B. Activities have the potential to temporarily displace some recreationists; however, return to pre-disturbance activity patterns is expected to occur rapidly once construction is complete. Long-term facilities would be located in areas of low recreation potential or areas already developed. Noise sources like compressors and artificial-lift equipment that may be placed in or near recreation sites such as Nelson Reservoir and the Montana FWP's Cole Ponds FAS would remain for the long term. Roughly four in ten of the cumulative wells in the field would likely be using artificial lift after all new and replacement wells are developed under Alternative B.

4.7.1.3 Alternative C—Maximum Development

Direct and Indirect Impacts

The effect to recreation resources under Alternative C would be similar to that described under Alternative B, except that effects may spread further across the project area because more wells would be drilled each year during the development stage. Under Alternative C, drilling would occur at the rate of about 36 wells per month using three rigs. All of the additional wells would be on federal surface, so about twice as much federal surface and half again as much total surface within the project area would potentially see drilling activity.

Previous well-development patterns and the distribution of land according to surface ownership indicate that under Alternative C the additional drilling of federal wells and potential effects to recreation resources would more likely occur in the northern third of the project area (Figure 1.1-1). Additionally, blocks of previously undrilled federal land exist in the central and southern parts of the project area, so recreation resources in these areas—mainly areas hunted for big game, birds and waterfowl—could also be affected by the occurrence of drilling activity.

Under Alternative C, the potential effect to recreation resources that support hunting, wildlife observation, and use of the campground and cabin sites near Nelson Reservoir and the Bowdoin NWR would likely be similar to that of Alternative B.

The use of artificial lift equipment as described in Chapter 2 would potentially introduce noise sources in or near areas of recreational use at Nelson Reservoir and at the Montana FWP's Cole Ponds FAS. Areas most sensitive to noise would be the developed recreation sites and cabin sites around Nelson Reservoir. The potential for noise effects to recreation would be greater under Alternative C because roughly 60 percent more new and replacement wells would be developed under Alternative C than under Alternative B. As it is would be under Alternative B, public land within the Nelson Reservoir recreation area is included in under Alternative C, so wells may be developed within the recreation area and potentially closer to developed recreation sites and cabin sites.

Seven of 10 of new and replacement wells developed under the alternative would likely use artificial lift, as implied by data in Table 2.2-4. The potential for noise exposure in or near recreation areas would depend on an Operator's decision whether to use artificial lift at a given well location, what type of equipment to install, and where to place the artificial lift equipment at the well location. The sound level experienced at a given recreational site also would depend on these Operator decisions. Noise exposure from artificial lift equipment potentially would last the life of the project.

Installing noise-reducing types of artificial lift equipment would lower the potential for noise impacts to recreation. Alternative C includes the same options for artificial lift as Alternative A, and the quieter options for the equipment are also as described under Alternative A.

Mitigation

To minimize the potential for noise impacts near developed recreation sites under Alternative C, Operators would apply the noise mitigations described under Alternative A.

Cumulative Impacts

The short-term disturbances to recreation resources under Alternative C are not expected to contribute to the long-term cumulative impacts on the area.

Overall, there are no long-term or far-reaching impacts on recreation by project activities associated with this field-development project under Alternative C. Activities have the potential to temporarily displace some recreationists; however, return to pre-disturbance activity patterns once construction is complete is expected to occur rapidly. Long-term facilities would be located in areas of low recreation potential or areas already developed. Noise sources like compressors and artificial-lift equipment that may be placed near recreation sites such as Nelson Reservoir and the Montana FWP's Cole Ponds FAS would remain for the long term. Roughly five in 10 of the cumulative wells in the field would likely be using artificial lift after all new and replacement wells are developed under Alternative C.

4.7.2 Visual Resources (VRM)

4.7.2.1 Alternative A—No Federal Action

Direct and Indirect Impacts

Visual Resource Management (VRM) objectives would not apply to private and state wells or the associated infrastructure that would be developed in the project area under Alternative A. Therefore, natural-gas development on surface areas under private and state control may or may not be implemented using design and mitigation practices consistent with the existing character of the landscape.

Cumulative Impacts

On private and state lands within the project area, where the existing landscape is now predominantly rural, additional development would be expected over time. This is consistent with the broad trends in the State of Montana. However a BLM decision not to approve federal wells under Alternative A, limiting natural-gas development to private and state lands, would reduce cumulative change over time to the project area's existing landscapes. Alternative A would add to the substantial level of impact to visual resources in the immediate area associated with historic and ongoing oil and natural-gas development. The composite experience of those traveling through the area, particularly on back roads, is one of a highly modified landscape. Contrasts in line, form, color, and texture begin to dominate the viewer's experience. Views of large, relatively undisturbed patches of the characteristic northern Montana landscape are becoming less common. These conditions would increase the likelihood that viewers, particularly backcountry recreationists, would be dissatisfied with the visual component of their recreation experience.

4.7.2.2 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts

The visual resources of the BNGPA are delineated according to VRM Class (Figure 3.7-1). The criteria for the acceptability of effects due to Alternative B are the management decisions for visual resources from the approved JVPRMP (BLM-LDO 1994*a* and 1994*b*).

Approximately 84 percent of the federal surface within the project area would be managed to achieve a Class IV objective. Within Class IV the change to existing landscapes from the development of wells and associated infrastructure would be acceptable, assuming every attempt is made to use location, minimization of disturbance, and characteristic elements of form, line, color, and texture in the design of surface facilities, with an emphasis on proper choice of color. However, a visual contrast rating of proposed surface facilities would not be required in Class IV areas (BLM-LDO 1994*a* and 1994*b*).

Approximately 12 percent of the federal surface within the project area would be managed to achieve a Class III objective, which is to partially retain the existing character of the landscape. Within Class III the change to existing landscapes from the development of wells and associated infrastructure would be acceptable, assuming surface facilities are designed or may be mitigated to achieve the Class III objective of no more than moderate, uncharacteristic contrast to the existing landscape that does not dominate the view of the casual observer.

Approximately 4 percent of the federal surface within the project area would be managed to achieve a Class II objective, which is to retain the existing character of the landscape. Within Class II the change to existing landscapes from the development of wells and associated infrastructure would be acceptable, assuming surface facilities are designed or may be mitigated to achieve a low level of uncharacteristic contrast to the existing landscape that does not attract the attention of the casual observer. In Class II areas surface facilities should use naturally appearing form, line, color, and texture, unless an exception is made. Exceptions are discussed below.

As noted in section 1.4.2, use authorizations (i.e., rights-of-way, permits, etc.) for well pads, roads, power lines, pipelines, and well site facilities would be processed through the BLM APD and Sundry Notice permitting process when located on-lease. Any activity located off-lease would require an approved right-of-way. Permitted surface developments would be designed or mitigated to complement and harmonize with the natural features and VRM class objectives. BLM's visual contrast rating would be used as a guide within VRM Classes II and III areas. VRM class objectives may not always be met due to non-discretionary actions or exceptions which may occur after evaluation and at the discretion of the authorized officer (BLM-LDO 1994*a* and 1994*b*).

Current BLM policy is to use appropriate environmental BMPs for mitigating anticipated impacts to surface and subsurface resources (USDOI-BLM IM 2007-021). Additional mitigating measures may be recommended pursuant to a visual contrast rating of the surface facilities proposed in an APD, sundry notice, or right-of-way application. Appropriate mitigating measures would be developed from Field Office experience on a case-by-case basis and incorporated as a condition of use. A menu of typical BMPs for mitigating the visual resources impacts of oil and gas development is published by the BLM Washington Office of Fluid Minerals (USDOI-BLM Best Management Practices).

Of the options for artificial lift described in Chapter 2, the use of PJ units would potentially introduce new elements of visual disturbance to BLM lands in VRM Class II or III, with Class II being the more sensitive. A PJ unit has a wide profile of up to 16 feet and a height of 13.5 feet at maximum extension during a stroke of the pumping arm. This raises the likelihood of a PJ unit being prominent in the foreground of a view and of it creating uncharacteristic contrast with the skyline as seen by a casual viewer. The motion of PJ units also would likely attract the viewer's attention. A visual impact caused by a PJ unit would potentially last the life of the project.

Seven of 10 of new and replacement wells developed under Alternative B would likely use artificial lift, as implied by data in Table 2.2-4. Visual impacts may occur under Alternative B because, unlike Alternative A, new and replacement wells would potentially be drilled on BLM land in VRM Class II or III near the Nelson Reservoir recreation area and the Bowdoin NWR complex, along reaches of the Milk River, and in parts of the tributary Little Cottonwood and Beaver Creeks.

The potential for a visual impact on VRM Class II or III land depends on an Operator's decision whether to use a PJ unit at a given well location; the placement of the unit with respect to topography, vegetation, and its potential viewers; and the presence of an observation point with a view of the unit. As noted in Chapter 2, the Operator's use of color would potentially reduce a visual impact caused by a PJ unit.

Potential viewers include recreational users who may be sensitive to adverse contrast from PJ units in the higher-rated BLM landscapes of the BNGPA (Section 3.7.2). The sites likely to contain these viewers are near Nelson Reservoir, in the Milk River riparian area, at Montana Fish, Wildlife and Parks FAS along the Milk River, and in waterfowl-oriented units of the NWR complex (Section 3.7.1).

Mitigation

Minimizing potential visual impacts from PJ units should include consideration of whether a well can be relocated to take advantage of distance, vegetation, or topography to reduce its visibility or contrast with the characteristic landscape from the point of view of recreational use of BLM land. When it can be used, site selection can be critical (as is color choice) in reducing the contrast of a PJ unit.

Since the visual impact potential of a PJ unit depends on location, VRM land classification, and visibility from BLM land in and near recreation sites, a determination of impact would require analysis of the specific circumstances surrounding a well. This would occur when Operators submit an APD.

Operators would submit a visual impact analysis of a well location on VRM Class II and III land as part of an APD. The analysis would use BLM's VRM contrast rating system (BLM Manual Section 8431). BLM at its option would investigate and analyze well locations; at its discretion, BLM may require an Operator to move a facility up to 600 feet in order to reduce the impact to views of BNGP facilities from recreational sites on BLM land.

As indicated, the additional mitigation would apply to VRM Class II land managed for retention of existing character (approximately four percent of the federal surface in the BNGPA) and to Class III land managed for partial retention (approximately 12 percent). Determination of the need for additional mitigation would be made according to BLM Field Office experience on a case-by-case basis and incorporated as a condition of approval (COA).

Residual Impacts

The imperative of economical well development and the study area's surface character and uses may jointly limit an Operator's ability to mitigate the visual impact of PJ units. Therefore, some residual visual impact to views may occur on VRM Class II and III land. Impacts are difficult to predict because of the uncertainty associated with an Operator's need to use a PJ unit and variability of surface character and uses in the BNGPA.

4.7.2.3 Alternative C—Maximum Development Alternative

Direct and Indirect Impacts

Direct and indirect impacts would be similar to those described in Alternative B, including the potential for visual impact from PJ units that may be used for artificial lift. The frequency of occurrence of visual impacts from PJ equipment would likely be higher under Alternative C than under Alternative B because of the higher number of wells proposed for development under Alternative C.

Mitigation

The need for additional mitigation under Alternative C would be similar to that presented under Alternative B. As noted, the frequency of occurrence of visual impacts needing additional mitigation may be higher under Alternative C because more wells would be developed under Alternative C than under Alternative B.

Residual Impacts

The analysis of residual impacts under Alternative C would be similar to that presented under Alternative B, with the possibility that the frequency of occurrence of residual impacts could be higher in proportion to the higher number of wells proposed under Alternative C.

Cumulative Impacts

Alternative C would add a greater cumulative impact than Alternative B to the substantial level of impact to visual resources in the immediate area associated with historic and ongoing natural-gas development. The composite experience of those traveling through the area, particularly on back roads, is one of a highly modified landscape. Contrasts in line, form, color, and texture would begin to dominate the viewer experience. Views of large, relatively undisturbed patches of the characteristic northern Montana landscape are becoming less common. These conditions would increase the likelihood that viewers, particularly backcountry recreationists, would be dissatisfied with the visual component of their recreation experience.

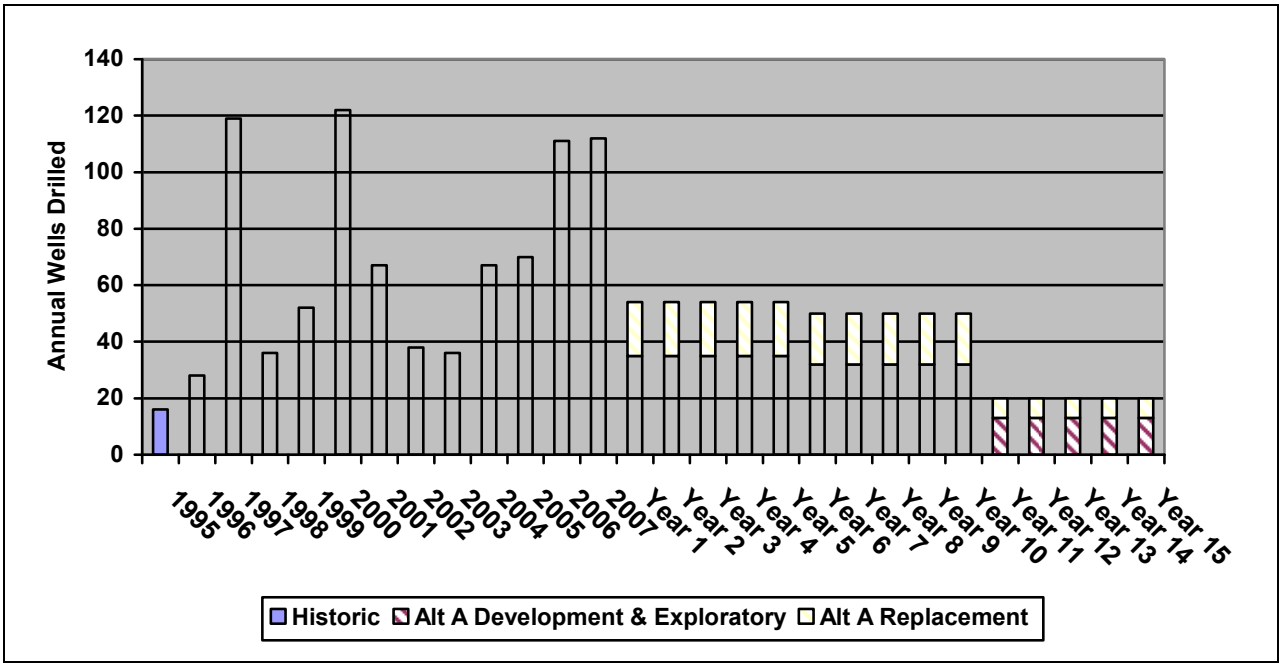
Upon completion of Alternative C, roughly five in 10 of all wells in the field on a cumulative basis would potentially be using artificial lift. This would reinforce the trend of landscape modification in much of the BNGPA. Where PJ equipment is used for artificial lift, Alternative C would potentially impact visual quality on VRM Class II or III land; this would represent a new layer of impact to the cumulative environment and may occur more frequently in proportion to the higher number of wells proposed under Alternative C.

4.8 SOCIOECONOMICS

4.8.1 Alternative A—No Federal Action

Social and economic effects of each alternative would be driven in large part by the pace of development and the resultant level of natural gas production. Figure 4.8-1 displays recent annual drilling levels in the BNGPA and assumptions about anticipated future drilling levels associated with Alternative A. As can be seen from the historic data, drilling levels vary, based on the price of natural gas, issuance of the required permits and approvals, availability of drilling rigs, and individual company development strategies, among other factors. Annual drilling assumptions have been developed to allow analysis of social and economic effects. The assumptions used for this assessment have been developed in consultation with the Operators. In recognition of the fact that annual drilling levels cannot be predicted with certainty, potential effects of higher or lower annual drilling rates were also considered in the assessment.

Figure 4.8-1. Historic and Assumed Alternative A Drilling Levels



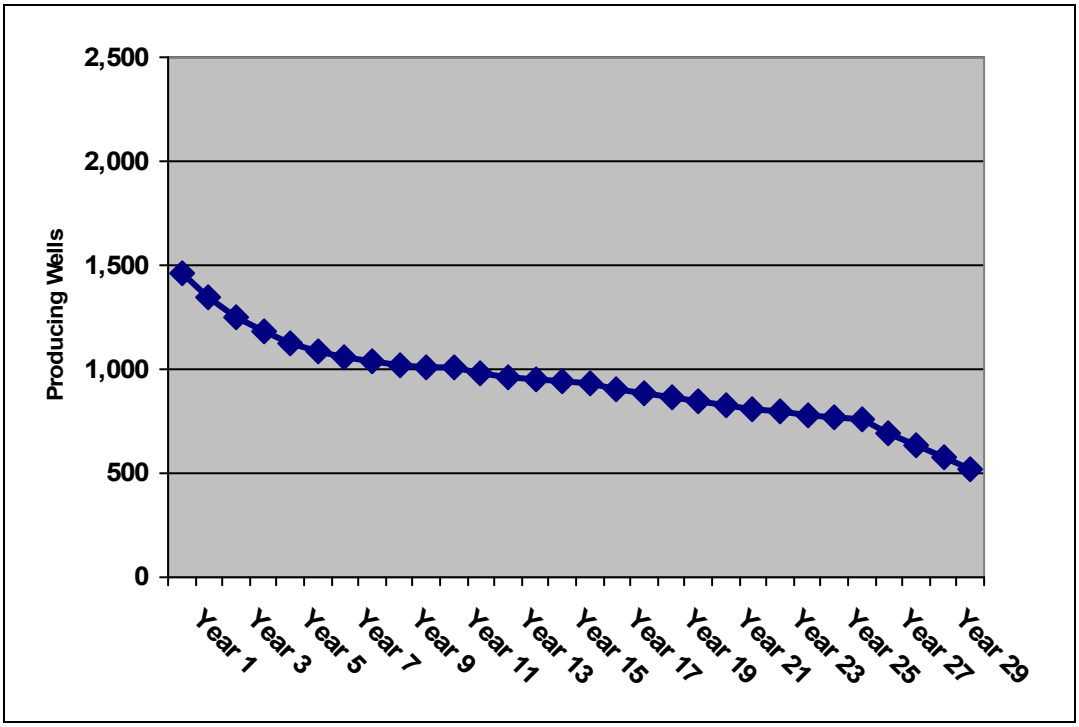
Source: 1995–2005, Bowdoin Operators: 2006 & 2007 Montana board of Oil and Gas:Year 1–15 are averages, prepared by BCLLC based on estimates by the Bowdoin Operators.

For Alternative A, this assessment assumes an annual average rate of 54 wells (35 development/exploratory and 19 replacement) during the first five years of development, 50 wells (32 development/exploratory and 18 replacement) during the second five years, and 20 wells (13 development/exploratory and 7 replacement) during the final five years of development (see Figure 4.8-1). The assumed Alternative A average annual drilling rate of 54 wells would be lower than the 1996–2007 annual average (67 wells) and lower than the 2006–2007 drilling levels (111 and 112, respectively). Although the average annual number of rigs could be drilled with one rig, it is possible that additional rigs could be drilling in the BNGPA for relatively brief periods of time. High commodity prices may encourage higher levels of drilling in some years. The availability of rigs and crews, industry plans, and actual drilling experience may encourage lower rates of drilling.

Figure 4.8-2 below displays the projected number of producing wells in the BNGPA over the assumed LOP for Alternative A, including existing wells. Wells in the BNGPA have a typical production life of about 24 years. Thus, all of the existing and many of the new wells drilled under these alternatives would reach the end of their productive life by the end of the 30th year, which is the end of the analysis period for this assessment. Additionally, 35 percent of all wells drilled would be replacement wells; consequently, the total number of wells in production would decline from 1,459 in the first year of drilling to 521 in the 30th year under Alternative A. [c]

[c] No production is assumed for exploratory wells.

Figure 4.8-2. Projected Number of Producing Wells in the BNGPA: Alternative A



Source: BLM for Alternative A Drilling Levels; Bowdoin Operators for production estimates

Direct and Indirect Economic Impacts

Employment: Direct employment associated with all alternatives includes the seasonal drilling, completion and infrastructure construction crews that come to the area on a temporary seasonal basis, local contractors that support construction and operations, fieldmen or pumpers that check and maintain wells and monitor production, employees associated with pipeline transmission activities, and administrative employees associated with field and pipeline operations. The latter three categories are generally full-time, year-round jobs based in the region. The seasonal employment is assumed to be a function of the pace of development and the number of rigs deployed, assuming an average of 52 seasonal jobs per rig and associated completion/infrastructure-development crews. For this assessment there are presently estimated to be 56 full-time operations jobs associated with the BNGPA, consisting of two elements: 30 jobs associated with pipeline transmission, and 24 jobs associated with field production and operations. The latter varies based on the number of producing wells.

The economic activity associated with new drilling and field development and with ongoing production and transmission would stimulate secondary job opportunities and income in the region. Secondary employment consists of indirect jobs supporting drilling and production activities and induced jobs supported by consumer expenditures of the direct and indirect employees.

The relationship between direct and total economic effects, often referred to as the 'multiplier effect,' varies by industry and region. Variations in the multiplier effect reflect differences in relative intensity of labor and capital, wage rates, and the location of support industries in the region. In general, rural areas, such as the BNGPA, with relatively undiversified economies, have lower multipliers than do larger, more diversified economies. Employment and income multipliers associated with oil and gas development in the BNGPA are shown in Table 4.8-1.

For example, according to the IMPLAN (impact analysis for planning) model, which is an input-output based model commonly used by the BLM and other agencies to examine the effects of resource management planning alternatives, each direct job in oil and gas extraction supports 1.36 additional secondary jobs.

Table 4.8-1. Employment and Income Multipliers for Oil and Gas Development and Operations in Phillips and Valley Counties, 2003

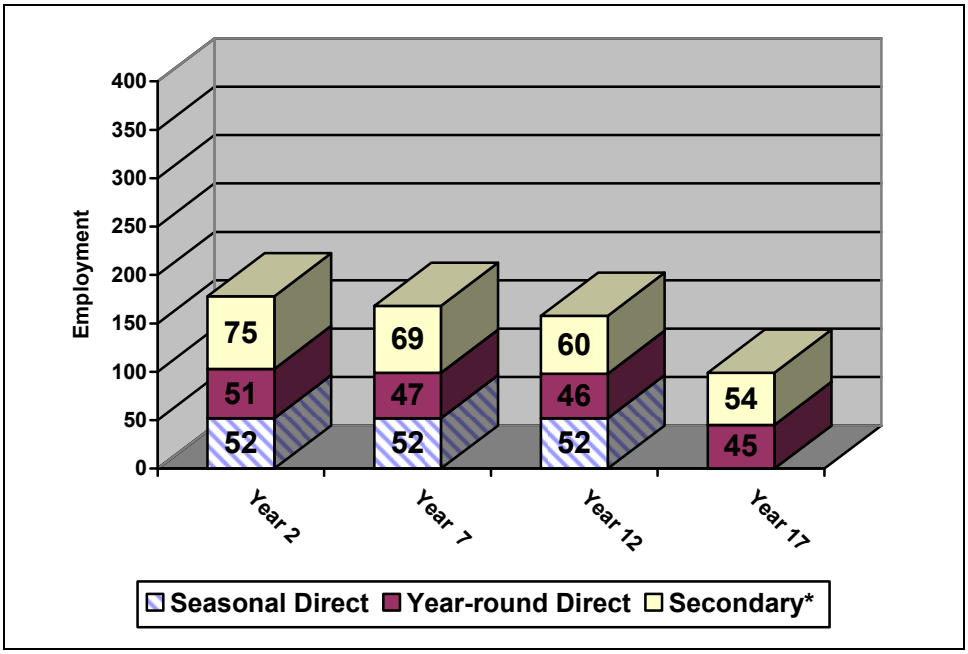
	Oil & Gas Drilling [1]	Oil & Gas Extraction	Support for Oil & Gas	Pipeline Construction	Pipeline Transportation
Jobs Multiplier	2.18	2.36	1.57	1.27	3.49
Labor Income Multiplier	1.81	1.52	1.19	1.22	1.74

[1] These multipliers are statewide multipliers for Montana
Source: Minnesota IMPLAN Group, 2005

Combining the estimates of direct employment, both seasonal and full-time, with jobs supported by the spending of seasonal workers and secondary jobs, yields the total estimated employment effects of Alternative A. Figure 4.8-3 displays employment by category for selected years and Figure 4.8-4 displays total project-related employment over time.

Phillips and Valley county residents would continue to benefit directly and indirectly from the economic activity associated with natural-gas development and production under Alternative A, although at lower levels as compared to the 1996–2005 annual average. The reduced levels of drilling and subsequent production would result in fewer direct and indirect jobs and fewer purchases from local businesses.

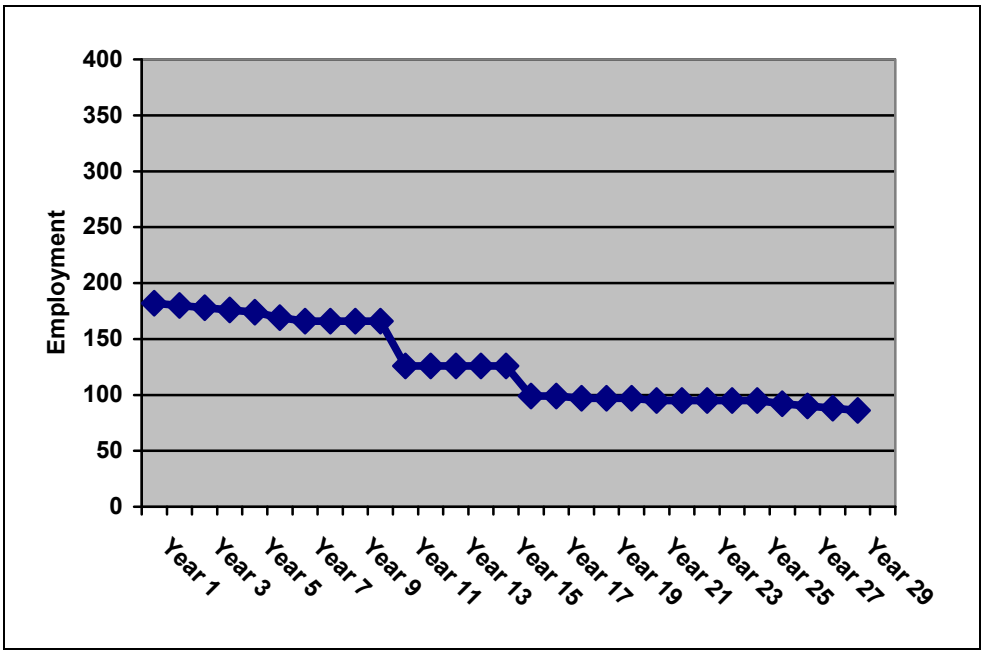
Figure 4.8-3. Estimated Total BNGPA-Related Employment by Category: Alternative A



* Secondary includes indirect and induced employment.
Source: BCLLC/Sammons/Dutton LLC calculations

Under Alternative A, the direct and secondary job effects would diminish over time as fewer numbers of wells are drilled and the number of producing wells declines. Although the number of seasonal jobs would remain the same throughout the 10 to15-year drilling period, the duration of annual activity would become shorter as the number of new wells drops. Under Alternative A, estimated total BNGPA employment would drop from a high of 182 in Year 1 of development to 99 by Year 15, a decline of 46 percent over the 10 to 15-year period. Total Alternative A employment would represent about one percent of total 2004 Phillips and Valley county employment at the beginning of the development period, falling to about one percent after 15 years.

Figure 4.8-4. Estimated Total BNGPA-Related Employment: Alternative A



Source: BCLLC/Sammons/Dutton LLC calculations based on information provided by the Operators

Personal Income: Alternative A-related effects on regional personal income generally correspond to the employment effects described above. Temporary, seasonal increases would be associated with drilling, completion, and field-infrastructure construction. These direct jobs would help sustain regional trade jobs and incomes presently supported by the industry for another 15 years or longer, although at reduced levels compared to the recent past. Year-round oil and gas related incomes would also likely diminish under Alternative A. Table 4.8-2 displays estimated annual personal income generated in Phillips and Valley counties under Alternative A, based on the average direct earnings and income multipliers in IMPLAN.

Table 4.8-2. Personal Income in Phillips and Valley Counties Associated With Alternative A (millions of $2006)

	Year 2	Year 7	Year 12	Year 17	Total 30-Year Period
Alternative A	$ 6.1 M	$ 5.7 M	$ 5.4 M	$ 5.2 M	$ 155.1 M

Source: BCLLC/Sammons/Dutton LLC calculations based on information provided by the Operators

Direct and Indirect Impacts to Population

Based on the forecast baseline decline in population discussed in section 3.8 and the anticipated Alternative A-related reductions in direct and secondary employment as compared to recent levels, some corresponding reductions in Phillips and Valley county population would also be anticipated. These relatively small reductions would likely have the effect of modestly accelerating the currently anticipated population loss over the 15-year field-development period.

Direct and Indirect Impacts to Housing

Alternative A-related demand for temporary housing (motels and mobile home/RV spaces) would be similar in magnitude under Alternative A as compared to historic levels, but likely be substantially shorter in duration each year as a result of the fewer number of wells drilled during each annual drilling season.

Direct and Indirect Impacts on Local Government Services

Alternative A would result in slightly lower demand for local government services compared to current levels. County road maintenance would be the primary local government service affected by gas development and production activities. Demand for road maintenance services associated with drilling and field development would be lower than in the recent past. Road-maintenance service demand associated with production activities (well maintenance and water hauling) would also diminish as wells go off-line faster than they are replaced under Alternative A.

Direct and Indirect Fiscal Effects: Fiscal effects of natural-gas development in the BNGPA are associated with (1) government costs to provide services to development and operations activities and population, and (2) the revenues produced by gas development and production activities.

The reduced drilling rate associated with Alternative A would result in lower production levels and fewer tax revenues as compared to the recent past, requiring higher property taxes from other taxpayers to support the same level of county, municipal, and school district services.

Given that Alternative A-related natural-gas development and operations in the BNGPA would be somewhat lower than current and recent levels and therefore would be anticipated to place fewer demands on local government services (again, primarily road maintenance), BNGPA activity-related costs for local governments would be expected to fall.

Local and state government revenues would be associated primarily with the volume and value of natural gas produced, and with the ownership of the mineral estate from which that gas is produced. Under Alternative A, government revenues associated with BNGPA development and operations would continue, but at a somewhat reduced level as compared to current and recent levels, depending on natural gas prices. As shown in Figure 4.8-5, 558 wells would be drilled in privately-owned minerals and 62 in state-owned minerals under Alternative A. No wells would be drilled in federally-owned minerals unless required by unitization agreements or to prevent drainage of federal minerals.

Figure 4.8-5. BNGPA Projected Wells by Mineral Ownership: Alternative A

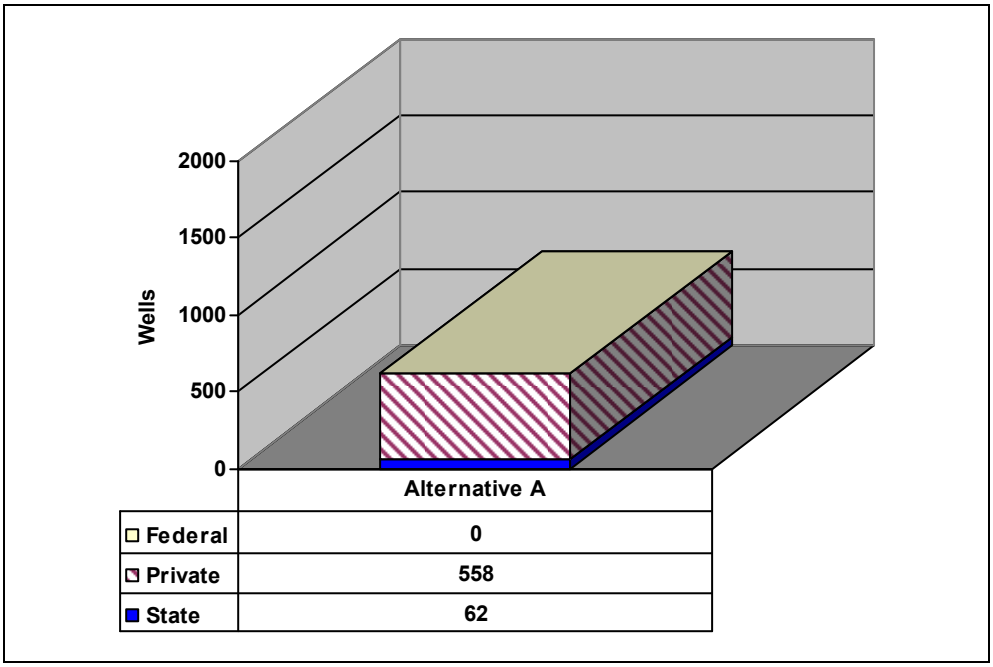
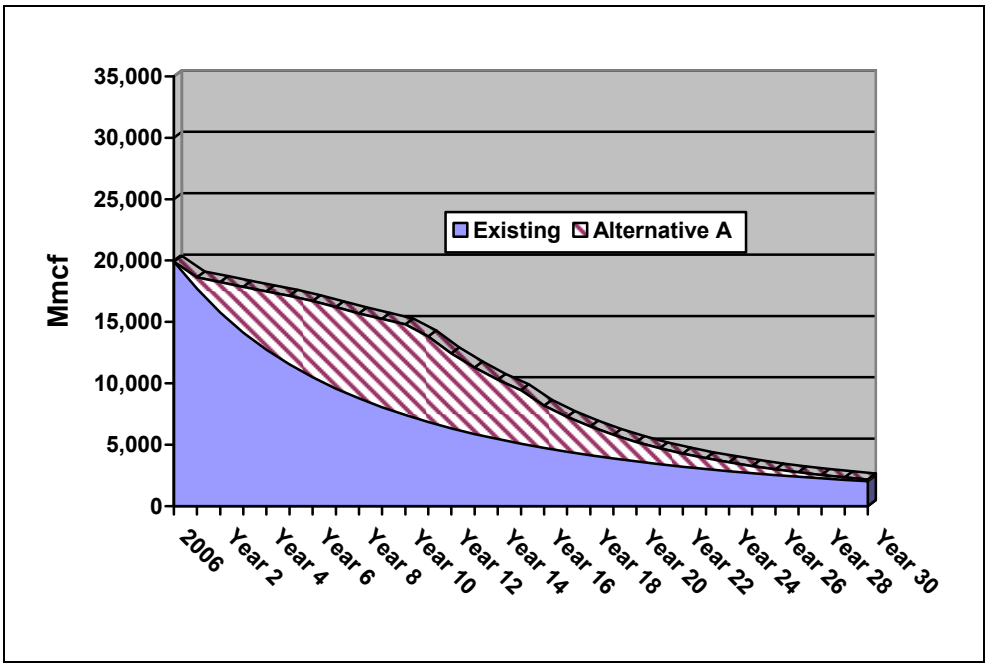


Figure 4.8-6 displays forecast natural gas production from existing BNGPA wells combined with forecast incremental production associated with Alternative A.

Figure 4.8-6. Forecasted BNGPA Natural Gas Production: Alternative A



Source: Projected production was derived by combining typical well production data provided by the Operators, estimates of the current annual production, and the projected number of new wells.

There are approximately 1,450 producing wells in the BNGPA at present, with estimated annual production of nearly 20 billion cubic feet (Bcf) of gas in 2006. Based on typical well production

data for the BNGPA, annual production from existing wells is expected to decline to less than 10 Bcf by Year 7 and less than 5 Bcf per year by Year 16. By Year 30 the projected annual production would fall to 2.0 Bcf. Cumulative projected production for the 30-year assessment period would be 290.6 Bcf including 193.1 Bcf from existing wells.

Under Alternative A, the Operators would drill 620 wells, of which approximately 90 percent are assumed to become production wells (no production is assumed for exploratory wells). Incremental production under Alternative A would climb steadily over time, peaking at about 7.4 Bcf per year in Year 10, and declining thereafter. Incremental production from the additional wells would temper, but not completely offset, the production declines from existing wells. Production from existing wells is projected at 7.4 Bcf in that year, resulting in total annual production of 14.8 Bcf in Year 10. Total production would fall below 10 Bcf in Year 15, eight years later than production from existing wells only. Under Alternative A, total annual production of 2.2 Bcf is projected in Year 30, mostly residual production from existing wells. Cumulative incremental production from Alternative A for the 30 year assessment period is projected at 97.5 Bcf, not including production from existing wells.

Under federal and Montana statutes governing natural-gas development, approval and implementation of Alternative A would generate the following public-sector revenues, directly and indirectly:

- Oil and gas production taxes on the value of production,
- Local ad valorem (property taxes) on the value of gas-field and pipeline equipment as well as commercial and residential property taxes supported by demand from direct and indirect BNGP-related employment,
- Personal and business state income taxes, and miscellaneous state and local governmental fees and charges for services.

Federal mineral royalties would continue from existing wells under Alternative A. Although no new wells would be drilled in federal minerals under Alternative A, some incremental federal mineral royalties could accrue as a result of unit agreements, and BLM would require Operators to drill in federal minerals if drainage of federal minerals were to occur. Given that the Operators would be allowed to drill in private minerals under Alternative A, additional royalty payments would accrue to private mineral owners under this alternative.

Local receipts of ad valorem taxes, along with local distributions of federal mineral royalties lag production, in some cases up to two years.

The bulk of future public-sector revenues would be associated with the volume, mineral-estate ownership, and taxable value of natural gas produced—factors which drive gas production taxes and mineral royalties. Projections of future revenues and their distribution from Montana production taxes are presented below for Alternative A. As previously noted, no incremental federal royalty revenues would be associated with Alternative A. The projected value of federal mineral royalties from existing wells was not estimated for this assessment because the distribution of current and projected production by mineral-estate ownership for existing wells was unavailable.

Projected natural gas production from the BNGPA for the 30-year assessment period would have a cumulative value of $1,743.8 million under Alternative A. The majority of that value (66 percent) is associated with future production from existing wells, with $585 million projected

from new wells on state and private leases. Montana state gas-production taxes on that production, after allowances for deductible production costs, exemptions for royalty payments, and the lower tax rate for the first 12 months of production, are estimated at $153.7 million (see Table 4.8-3). As shown in Figure 4.8-6 above, the incremental production under Alternative A would be insufficient to stem the long-term declines associated with the existing wells. However, Alternative A-related production would prolong current levels of production, and hence the associated gas production taxes, at higher levels than would result from existing wells only.

Table 4.8-3. Projected Montana Gas Production Tax Revenues: Alternative A

	Existing & Alternative A
Cumulative Production (MMcf)	290,627
Cumulative Production Value (@ $6.00 / Mcf)	$ 1,743.8 Million
Cumulative Gas Production Tax	$ 153.7 Million

Sources: Production: Bowdoin Operators. Revenue forecasts: BCLLC/Sammons/Dutton LLC

Based on current tax allocation formulas, revenues totaling $71 million in gas-production taxes would accrue to the State of Montana under the Proposed Action; $82.7 million would accrue to Phillips and Valley county government entities, with the largest share going to selected schools and municipalities (see Table 4.8-4).

Table 4.8-4. Distribution of Gas Production Taxes, 30-Year Assessment Period: Alternative A (millions)

	Existing and Alternative A	
State of Montana	$ 71.0 M	
Local	**Phillips County**	**Valley County**
Education retirement	$ 5.3 M	$1.2 M
General education	$30.9 M	$3.2 M
County-wide transportation	$ 0.8 M	$0.4 M
Municipalities	$25.2 M	$2.1 M
County general purpose	$12.6 M	$1.0 M
Local Government Total	**$74.8 M**	**$7.9 M**

Source: BCLLC/Sammons/Dutton LLC

An additional 62 gas wells would be drilled on state leases under the No Action alternative. The state would collect royalties on the value of the production, as well as on the value of production from existing wells on state leases. Estimated state royalties, assuming a 14 percent average state royalty rate and projected production would total about $6.9 million through the 30-year assessment period.

Other Revenues

Alternative A would generate other state and local tax revenues, principally personal and corporate income taxes and local ad valorem property taxes. Other miscellaneous revenues and fees—for example, motor fuel taxes and vehicle-licensing fees—would also be generated.

Income taxes would be a function of (1) the incomes of workers, whose jobs are supported by the individual alternatives, both directly and indirectly; (2) the corporate income generated by the ongoing drilling, completion, and production; and (3) the related activities of local suppliers

and support businesses. The incremental income and associated income taxes are not quantified in this analysis, but would be a direct result of the employment; therefore, Alternative A income and corporate taxes would be lowest of the three alternatives. These revenue effects would be long-term, extending over the course of the drilling program and through the economic life of the project.

Ad valorem property taxes would be levied on the gas-field equipment, pipelines, and commercial and residential real estate value supported by the project. New gas-field equipment and pipeline investment would occur in conjunction to the additional drilling, increased local industrial assessments, and perhaps the valuation on centrally assessed infrastructure and pipelines. Given that Alternative A would result in the lowest levels of infrastructure development of the three alternatives, and that employment levels are likely to decline with perhaps some associated decrease in demand in residential property, Alternative A would likely result in diminished ad valorem property tax revenues as compared to either Alternative B or C or current conditions.

Direct and Indirect Impacts on Specific Groups

The Alternative A-related reduction in annual drilling levels as compared to recent and historic 10-year annual average levels, coupled with the anticipated reductions in gas production compared to current levels, would result in corresponding reductions in direct and indirect employment. At the beginning of the 15-year development period, Alternative A-related employment would equal about two percent of 2004 total Phillips and Valley county employment, falling to about one percent towards the end of the period. Consequently, reductions in employment would modestly accelerate the currently forecast population loss (8 percent in Phillips County and 14 percent in Valley County during this period), particularly near the BNGPA where many current gas industry employees reside. The modest reduction in population, coupled with the perception that another local industry was in decline, would likely result in a reduction in community well-being for some residents of Phillips and Valley counties. Over time, the anticipated increase in property tax rates and/or reduction in local government service levels associated with diminishing natural gas-related tax and royalty revenues could also result in reductions in quality of life for some residents.

Ranchers, farmers, and other land-owners would experience fewer split-estate conflicts under Alternative A because the Operators would not drill on split-estate lands where the federal government owns the mineral estate. Consequently, split-estate conflicts would be limited to private lands where the surface and subsurface estates are in different private ownership. Given that fewer wells would be drilled in the future under Alternative A, split-estate conflicts would also be anticipated to diminish as wells cease production and are abandoned and reclaimed. A reduction in split-estate conflicts would likely reduce the potential for dissatisfaction. As wells on split-estate lands cease production and are reclaimed, some affected ranchers and farmers could experience enhanced well-being and quality of life.

Recreation users of private and state lands within the BNGPA could be temporarily displaced or experience changes in the recreation setting if drilling, completion, or infrastructure construction activities on private or state-owned land coincide with the season of use, which is predominately during the fall hunting season as discussed in section **4.7.1, Recreation**. Substantial natural-gas development changes in the recreation setting on BLM land or private land where the BLM holds the mineral estate would not be anticipated under Alternative A. The avoidance of gas development on federal lands and minerals and the reclamation of wells at the end of their productive life would lessen the potential for conflict with recreation users.

Individuals and groups who give a high priority to resource protection are likely to approve of the Alternative A-related reduction in disturbance, gas-development activity and environmental effects on BLM lands and private lands where the BLM holds the mineral estate, as compared to the two action alternatives.

Individuals and groups who give a high priority to resource use are likely to be dissatisfied with foregoing the economic benefits and tax and royalty revenues associated with Alternative A limitations on natural-gas development on BLM lands and minerals.

Environmental Justice

The percentage of minority residents in Phillips and Valley counties is not meaningfully higher than in the State of Montana as a whole. The percentage of minority residents in the census block groups that contain the BNGPA and communities near the project area are lower than the statewide average, and there are no concentrations of racial minorities in the BNGPA. Consequently, racial minorities would not be disproportionately affected by environmental or health effects of Alternative A, if any adverse environmental or health effects were to occur.

The percentage of low-income persons in Valley County is lower than in the state as a whole, but the Phillips County poverty rate is 3.7 percent higher than the statewide average. Valley County census block group 1001-1, which contains a portion of the BNGPA, is 0.4 percent higher than the State of Montana as a whole; Phillips County census block group 601-1, which contains most of Phillips County north of US Highway 2 and the bulk of the BNGPA, has a 10.1 percent higher poverty rate than the statewide average. Although the Phillips County portion of the BNGPA contains a higher percentage of low income residents than the state, the low population densities in this rural, remote area, the lack of concentrations of low-income persons, and the dispersed nature of BNGPA natural gas activities would preclude disproportionate environmental or health effects on low-income groups, if adverse environmental or health effects were to occur.

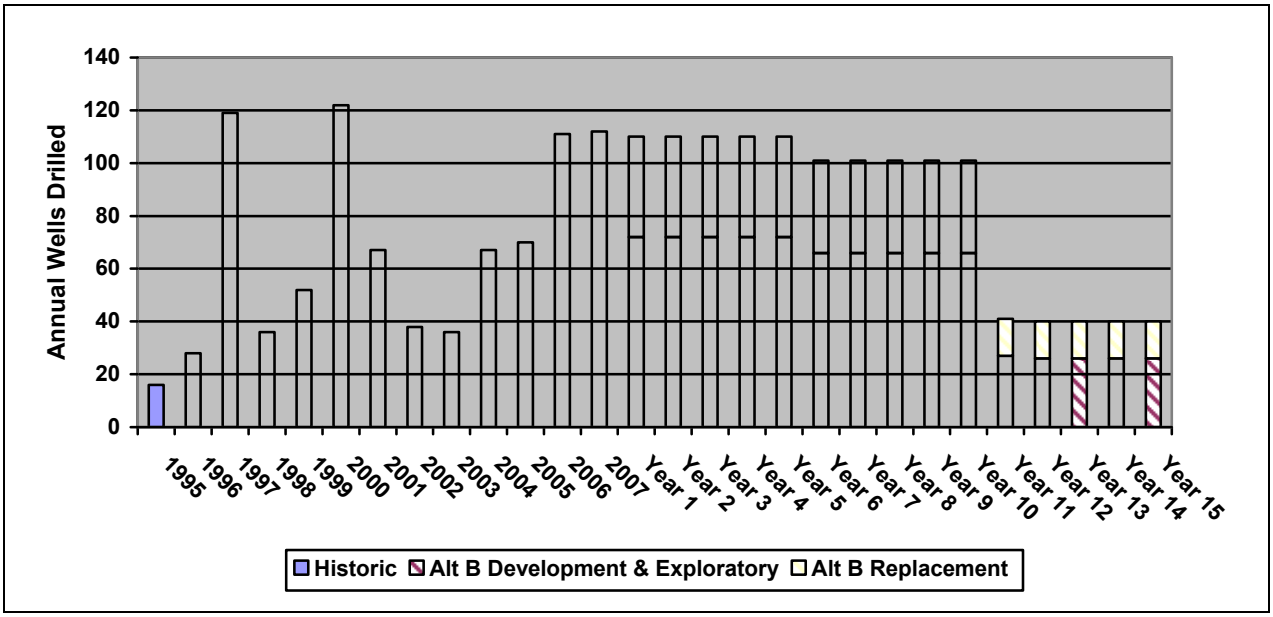
Cumulative Impacts

Past, present, and reasonably foreseeable future actions likely to generate cumulative social and economic effects to populations within and adjacent to the BNGPA, when combined with the effects of Alternative A, are limited to natural-gas development within the area. These effects have been included in the assessment for Alternative A.

4.8.2 Alternative B—Proposed Action with Additional Mitigation

Figure 4.8-7 displays recent historic and anticipated future drilling levels associated with Alternative B. For Alternative B, this assessment assumes an annual rate of 110 wells (72 development/exploratory and 38 replacement) during the first five years of development, 101 wells (66 development/exploratory and 35 replacement) during the second five years and 41 wells (26 to 27 development/exploratory and 14 replacement) during the final five years of development. This assumes Alternative B's annual drilling rate would be higher than the 1996–2007 annual average (67 wells) and about the same as the 2006–2007 annual levels (111 and 112, respectively), but lower than the peak drilling years of 1997 (119 wells) and 2000 (122 wells).

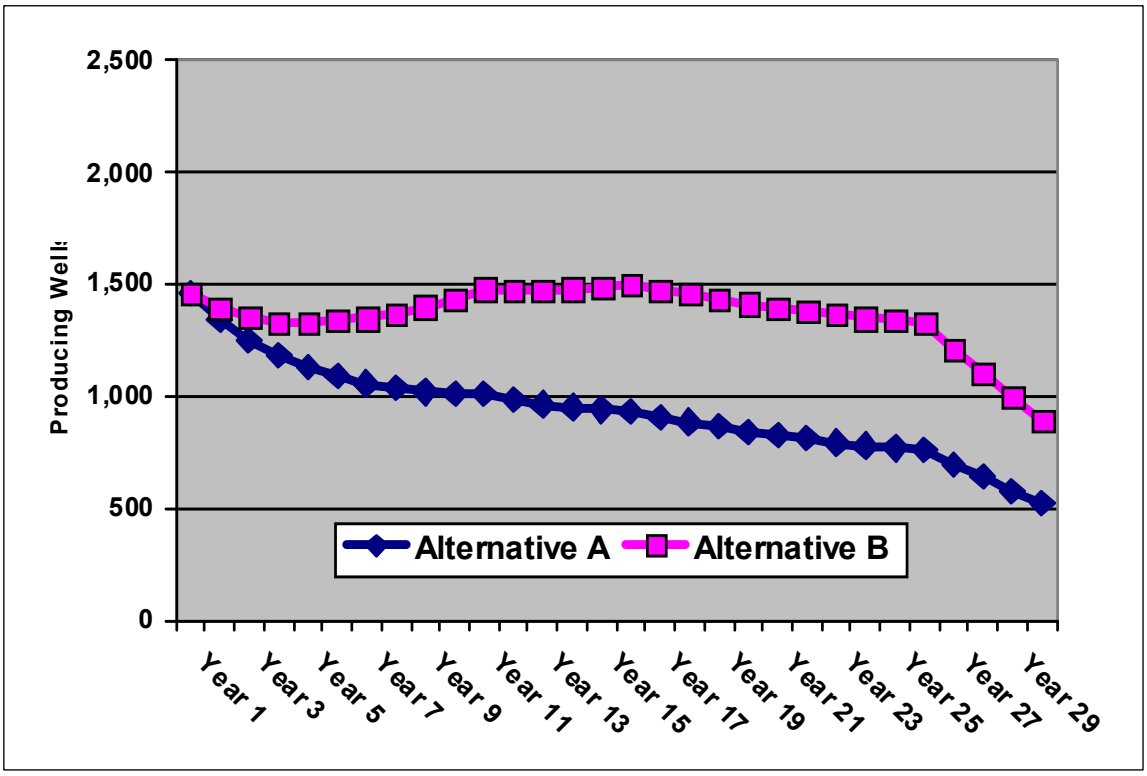
Figure 4.8-7. Historic and Assumed Alternative B Drilling Levels



1995–2005, Bowdoin Operators: 2006 & 2007 Montana board of Oil and Gas. Year 1–15 are averages, prepared by BCLLC based on estimates by the Bowdoin Operators.

Figure 4.8-8 displays existing and forecast future producing wells for Alternatives A and B. The number of producing wells (existing and new) under Alternative B would initially decline slightly, to 1,366 in Year 4, before climbing to a short-term peak of 1,500 in Year 14, which coincides with the assumed end of the new development. Thereafter, the number of producing wells would begin a steady decline to 890 wells by the end of the 30-year assessment period.

Figure 4.8-8. Projected Number of Producing Wells in the BNGPA: Alternative A & B



Source: Alternative A: BLM. Alternative B: Bowdoin Operators

Direct and Indirect Impacts to Employment

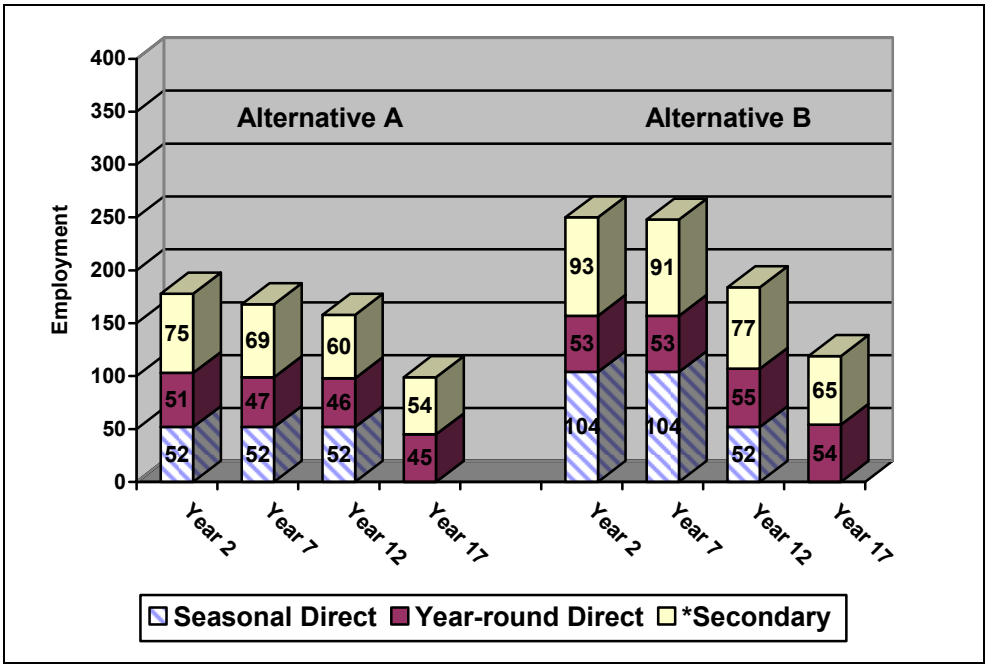
Alternative B would result in a higher pace of drilling activity as compared to Alternative A. Recent drilling levels in the BNGPA have been accomplished with one drilling rig, one completion crew, and one pipeline-construction crew relocating to the area for the duration of each drilling season and an additional rig or two relocating for brief periods. The higher level of development associated with Alternative B would likely require the deployment of an additional drilling rig and completion crew to the region. Economic effects of higher drilling/field-development activity levels include additional job opportunities and increased wages and salaries paid to labor.

The increased level of drilling activity would spawn additional demand for oil field services, as well as long-term demand for production-related and pipeline transportation services to move gas from the field into the market distribution channels. Those demands would result in increased demands for other vendors and suppliers, as well as for consumer goods and services supported by wages, salaries, and employee temporary living allowances, creating yet additional economic stimulus into the local economy.

The employment effects of Alternative B have been estimated using the same employment and income multipliers as for Alternative A (see Table 4.8-1). Combining the estimates of direct employment, both seasonal and full-time, with the jobs supported by the spending of seasonal and long-term workers and secondary jobs, yields the total estimated employment effects of Alternative B; see Figure 4.8-9 (employment by category for selected years) and Figure 4.8-10 (total project-related employment over time) below. Comparative employment impacts between Alternative A and B in Year 2 are 178 jobs under Alternative A and 256 for Alternative B. The

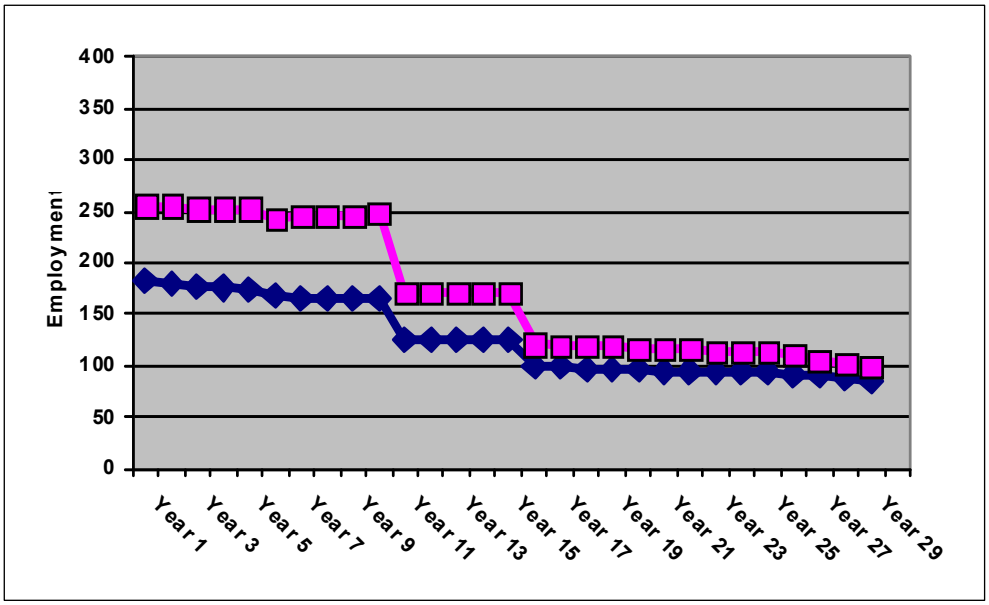
seasonal direct and secondary job effects are highest during the first 10 years of the assessment period due to the higher pace of assumed development. The number of such jobs declines over time under Alternative B as the pace of drilling drops to the point of only sustaining a single rig. Total Alternative B-related employment would represent about three percent of total 2004 Phillips and Valley county employment during the early years of drilling, dropping to about one percent of total 2004 employment in the two-county area at the end of the 15-year field development period.

Figure 4.8-9. Estimated Total BNGP-Related Employment by Category: Alternatives A & B



* Secondary includes indirect and induced employment.
Source: BCLLC/Sammons/Dutton LLC calculations

Figure 4.8-10. Estimated Total BNGP-Related Employment: Alternatives A & B



Source: BCLLC/Sammons/Dutton LLC calculations based on information provided by the Operators

The employment gains under Alternative B would provide an economic boost for the regional economy as compared to Alternative A, which would result in a reduction in employment as compared to current and recent historic employment levels associated with BNGPA activity.

Direct and Induced Effects on Personal Income

Alternative B-related effects on regional personal income generally correspond to the employment effects described above. Under Alternative B, higher levels of seasonal economic activity would be associated with higher levels of temporary seasonal drilling, completion, and infrastructure-construction activities. Although incomes associated with temporary seasonal jobs would generally not result in increases in regional income, these direct jobs would sustain regional trade jobs and incomes presently supported by the industry for another 10 years or longer at somewhat higher levels compared to the recent past. Year-round oil and gas-related incomes would also increase under Alternative B. Table 4.8-5 contrasts estimated annual personal income generated in Phillips and Valley counties by Alternatives A and B, based on the average direct earnings and income multipliers in IMPLAN. Alternative B would result in an estimated total of $155 million in personal income during the 30-year assessment period, a 17 percent increase in personal income compared to Alternative A.

Table 4.8-5. Personal Income in Phillips and Valley Counties Associated With Alternative A (millions of $2006)

	Year 3	Year 8	Year 13	Year 18	Total 30 Years	Increase over Alternative A
Alternative A	$ 6.1 M	$ 5.7 M	$ 5.4 M	$ 5.2 M	$ 155.1 M	-
Alternative B	$ 6.6 M	$ 6.5 M	$ 6.5 M	$ 6.3 M	$ 182.1 M	17%

Source: BCLLC/Sammons/Dutton LLC calculations based on information provided by the Operators

Direct and Indirect Impacts to Population

The Alternative B-related increases in temporary seasonal drilling, completion, and infrastructure-construction employment would not be anticipated to affect population levels in Phillips or Valley counties. Alternative B-related increases in year-round direct and secondary employment (about three percent of 2004 total employment in the two counties) would likely reduce the forecast trend of population decline discussed in section **3.8, Socioeconomics**, modestly slowing the currently anticipated population loss.

Direct and Indirect Impacts to Housing

Alternative B-related demand for temporary housing (motels and mobile home/RV spaces) would likely double under Alternative B during the first 10 years of development, because two drilling rigs, completion crews, and field infrastructure crews would likely be needed to accomplish the forecast level of development. This demand could be accommodated by regional temporary housing resources.

Direct and Indirect Impacts on Local Government Services

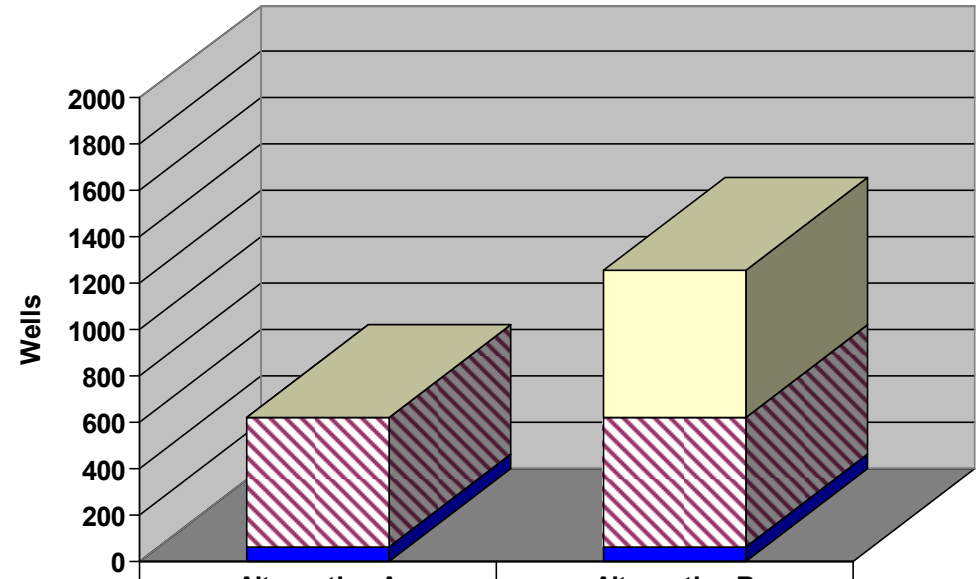
Alternative B would result in somewhat higher demand for local government services as compared to Alternative A and current levels. The increase in seasonal, temporary drilling, completion, and field-infrastructure construction crews could result in slightly increased demand for law enforcement, emergency management, and emergency medical services, although it is likely that these increases would not strain current resources in these areas. Increased demand for county road-maintenance activities would also increase, given the increased drilling and field-development levels and the increase in the number of wells that would require regular maintenance and water hauling. Counties would receive additional revenues from increased production and infrastructure investment, which could be used to offset the cost of increased government services and road-maintenance activities.

As with Alternative A, fiscal effects of Alternative B would be associated with government costs to provide services to development and operations activities and with the revenues produced by gas-development and production activities.

Alternative B-related natural-gas development and operations in the BNGPA would occur at higher levels as compared to Alternative A, and therefore place correspondingly higher demand on local government services (primarily road maintenance), resulting in somewhat higher costs for local governments.

Increases in local and state government revenues under Alternative B would result from the increased volumes of natural gas produced. Under Alternative B, local and state government would also receive additional revenues from distributed federal mineral royalty proceeds, which would not accrue under Alternative A. Figure 4.8-11 below contrasts the development assumptions by mineral estate ownership for Alternatives A and B.

Figure 4.8-11. BNGPA Projected Wells by Mineral Ownership: Alternatives A & B

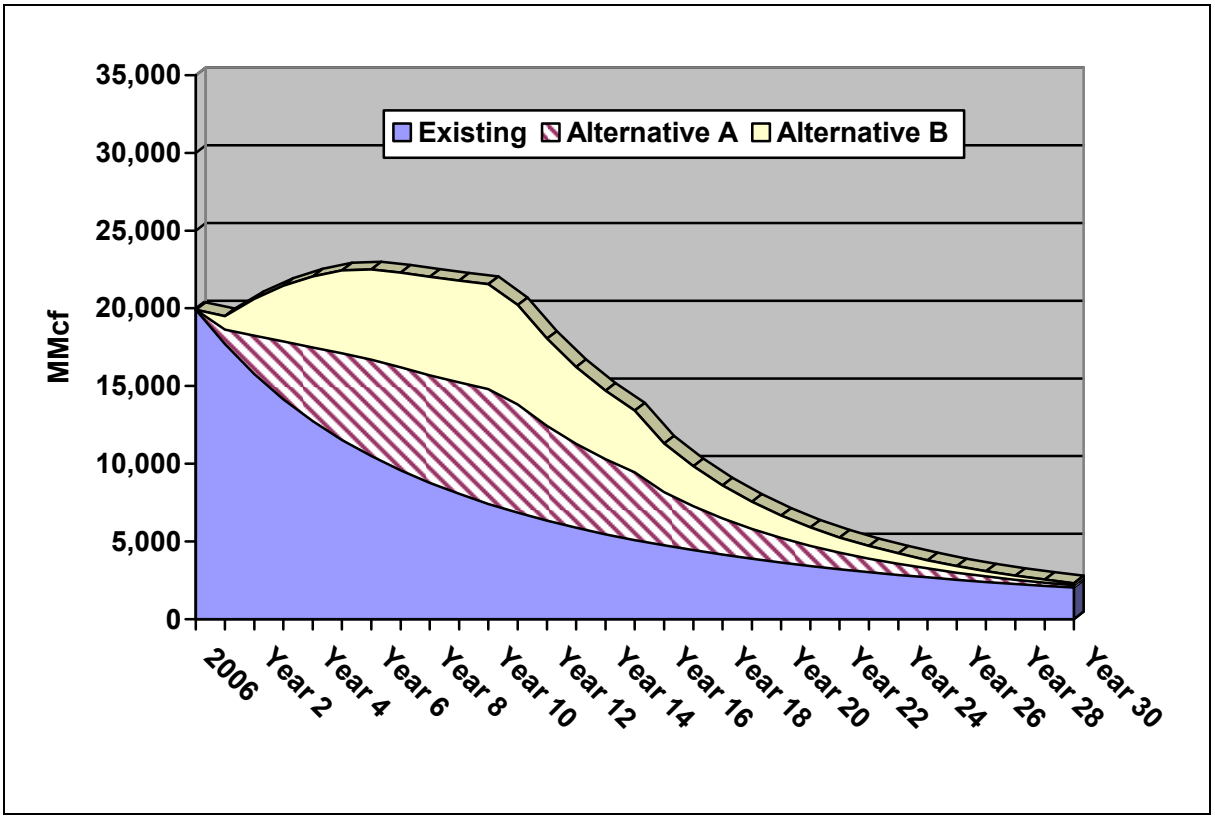


	Alternative A	Alternative B
Federal	0	635
Private	558	558
State	62	62

Figure 4.8-12 displays projected production from existing wells and the incremental production for Alternatives A and B.[d]

[d] Projected production was derived by combining typical well production data provided by the Operators, estimates of the current annual production, and the projected number of new wells.

Figure 4.8-12. Forecasted BNGPA Natural Gas Production: Alternatives A & B



Source: Projected production was derived by combining typical well production data provided by the Operators, estimates of the current annual production, and the projected number of new wells,

Alternative B includes the 620 wells on private and state minerals included in Alternative A as well as 635 new and replacement wells on federal lands. Production under Alternative B, when combined with that from existing wells, would result in a temporary increase in annual production substantially above recent levels. Peak production of 22.5 Bcf (including 10.5 Bcf associated with existing wells) is projected to occur in Year 6. Total annual production would fall below 10 Bcf in Year 17 and to 2.3 Bcf by the end of the 30-year assessment period. Cumulative production for the 30-year period under Alternative B would be an estimated 380.8 Bcf (including 193.1 Bcf of production from existing wells) as compared to 290.6 Bcf for Alternative A.

Table 4.8-6 displays projected Montana Gas-production tax revenues associated with Alternatives A and B. Production associated with Alternative B (including production from existing wells) would have a cumulative value of $2.28 billion over the 30-year assessment period, $541 million higher than Alternative A. This production would generate an estimated $199.8 million in production tax revenues, $46.1 million higher than production tax revenues estimated for Alternative A. Alternative B (including production from existing wells) would result in a modest increase in annual gas-production tax revenues above current levels (subject to changes associated with changing prices) through about Year 12. Thereafter, production and tax revenues would fall below current levels and continue to decline, though remaining above Alternative A levels throughout the assessment period.

Table 4.8-6. Projected Montana Gas Production Tax Revenues: Alternatives A & B

	Alternative A (Existing & Future New)	Alternative B (Existing & Future New)	Difference
Cumulative production (MMcf)	290.627	380,757	90,130
Cumulative production value (@ $6.00 / Mcf)	$ 1,743.8 M	$2,284.9 M	$ 541.1 M
Cumulative gas production tax	$ 153.7 M	$ 199.8 M	$ 46.1 M

Note: M = millions

Based on the current tax allocation formulas, revenues totaling $92.4 million in gas production taxes would accrue to the State of Montana under Alternative B; $71.0 million due to the additional development on state and private lands and an incremental $21.3 million from production from the federal wells (Table 4.8-7).

Table 4.8-7. Distribution of Gas Production Taxes, 30 Year Assessment Period: Alternatives A & B

	Alternative A (Existing & Future)		Alternative B (Existing & Future)		Difference	
State of Montana	$ 71.0 M		$ 92.3 M		$ 21.3 M	
	Phillips County	**Valley County**	**Phillips County**	**Valley County**	**Phillips County**	**Valley County**
Education retirement	$ 5.3 M	$ 1.2 M	$ 6.9 M	$ 1.6 M	$ 1.6 M	$ 0.4 M
General education	$30.9 M	$ 3.2 M	$40.1 M	$ 4.2 M	$ 9.2 M	$ 1.0 M
County-wide transportation	$ 0.8 M	$ 0.4 M	$ 1.0 M	$ 0.5 M	$ 0.2 M	$ 0.1 M
Municipalities	$25.2 M	$ 2.1 M	$32.7 M	$ 2.7 M	$ 7.5 M	$ 0.6 M
County general purpose	$12.6 M	$ 1.0 M	$16.4 M	$ 1.3 M	$ 3.8 M	$ 0.3 M

Note: M = millions

Local governments and school districts in the two counties would receive combined gas-production tax revenues of $107.4 million under Alternative B; $24.8 million higher than Alternative A. About 90 percent of that total, more than $97 million, is projected to accrue to entities in Phillips County. Projected revenues of $10.3 million would accrue to entities in Valley County under Alternative B. For both counties, local public school districts would receive the single-largest share of the gas development-related revenues to fund general education and educational retirement, about 48 percent in Phillips County and 31 percent in Valley County.

Federal Mineral Royalties (FMR): Mineral and energy resource producers typically pay a 12.5 percent royalty to the federal government on the value of surface coal, natural gas, oil, and other minerals produced on federal leases. One-half of the FMR receipts, net of an administrative processing fee, are subsequently disbursed to the state in which the production occurred. Under Montana statute, 25 percent of the state's annual FMR receipts are deposited into a mineral impact account, which are then distributed to counties from which the minerals are produced. The distribution formula is established by the legislature statutorily.

Projections of future FMR are based on the mineral estate ownership of wells within the project area, assuming all wells are equally productive. Under Alternative B, 635 wells would be drilled on federal leases, and hence, subject to FMR. Based on the projected production, value and allowances for deductible production costs, cumulative incremental FMRs of $62.0 million

associated with Alternative B are projected through 2036. Approximately $31.3 million would be retained by the federal government in the form of administrative fees and half the remaining revenue, an estimated $30.7 million would be dispersed to Montana. Of the state's share, an estimated $23.0 million would be retained by the state. Distributions to the two counties are estimated to total $7.7 million through 2036, with $6.9 million accruing to Phillips County and about $0.8 million accruing to Valley County. As noted, incremental FMRs associated with Alternative A would be limited to those generated by unitization agreements and those generated by wells drilled to avoid drainage of federal minerals.

State Royalties: Under Alternative B, the same number of wells (62) would be drilled in state-owned minerals as under Alternative A. The state would collect royalties on the value of the production, as well as on the value of production from existing wells on state leases. Estimated state royalties—assuming a 14 percent average state royalty rate—and projected production would total about $6.9 million over the 30-year assessment period, or the same as under Alternative A.

Other Revenues: Royalty income for owners of private minerals would be the same for both Alternatives A and B. Incremental income taxes are not quantified in this analysis, but would be higher under Alternative B than under Alternative A. The revenue effects would be long-term, extending over the course of the drilling program and through the economic life of the project.

Ad valorem property taxes, also not estimated for this assessment, would similarly be higher under Alternative B than under Alternative A. However, some increases in local government service demand, particularly in the area of road maintenance, would be associated with Alternative B; therefore somewhat higher local government service costs would partially offset these increases in revenues. The additional employment associated with Alternative B would also likely help maintain demand and market prices of existing real estate, helping to sustain property tax revenues from residential and commercial real estate. These effects are likely to be modest but long-term.

Direct and Indirect Impacts on Specific Groups

Some residents of Phillips and Valley counties would experience benefits of increased economic opportunity from the direct and secondary employment opportunities associated with Alternative B as contrasted with Alternative A. Alternative B-related employment would total about three percent of 2004 total Phillips and Valley county employment, but many of these jobs would be clustered in the area of Phillips and Valley counties surrounding the BNGPA. Some local businesses, particularly in communities immediately adjacent the BNGPA, would experience increased revenues and profits. The creation of new jobs and continuation of existing jobs would modestly reduce the anticipated rate of population loss in the study area (estimated at 8 percent in Phillips County and 13 percent in Valley County over the 15-year period), particularly in communities adjacent the BNGPA. These economic effects could result in enhanced well-being and quality of life for affected Phillips and Valley county residents during the period of increased economic activity.

The increased local government tax revenues associated with Alternative B as contrasted with Alternative A would likely result in either higher levels of local government services or lower tax rates for all taxpayers. These fiscal effects could result in an enhanced quality of life for some residents.

More ranchers, farmers, and grazing operators would be likely to experience split-estate conflicts under Alternative B as contrasted to Alternative A, as some portion of the 635 wells

drilled in federal minerals are likely to occur on split-estate lands and BLM lands leased for grazing. Correspondingly, the potential for conflict, dissatisfaction, and reductions in well-being and quality of life for some ranchers and farmers would increase under Alternative B as compared to Alternative A.

Given that Alternative B would involve drilling an additional 635 wells on BLM lands and minerals, the potential for temporary displacement of recreation users of lands within the BNGPA (primarily hunters) would be greater than that associated with Alternative A and would extend to federal lands. Temporary, short-term displacement or disruption of hunting activities would most likely occur in the fall. The increase in disturbance and number of producing wells would correspondingly change the recreation setting over a larger area of the BNGPA. This potential for temporary displacement and change in the recreation setting would increase the potential for dissatisfaction and decreased well-being among some recreation users under Alternative B as compared to Alternative A.

Individuals and groups who give a high priority to resource protection would be more concerned about impacts to resources and environmental values under Alternative B as compared to Alternative A because of the additional disturbance and environmental impacts associated with drilling and production of an additional 635 wells on BLM lands and minerals. These concerns may be tempered by the successful implementation of the BMPs and additional mitigation measures associated with Alternative B.

Individuals and groups who give a high priority to resource use would be more satisfied with Alternative B as compared to Alternative A, because of the additional economic activity and tax and royalty revenues associated with the higher level of development. This satisfaction could be reduced if some of these individuals and groups perceived that the environmental impacts of development were no longer minimal.

Environmental Justice

Although the number of wells drilled under Alternative B is substantially higher than Alternative A, the absence of concentrations of minority and low-income populations, the low population densities and the dispersed nature of BNGPA natural gas activities would likely preclude disproportionate environmental or health effects on minority or low-income groups, if adverse environmental or health effects were to occur.

Cumulative Impacts

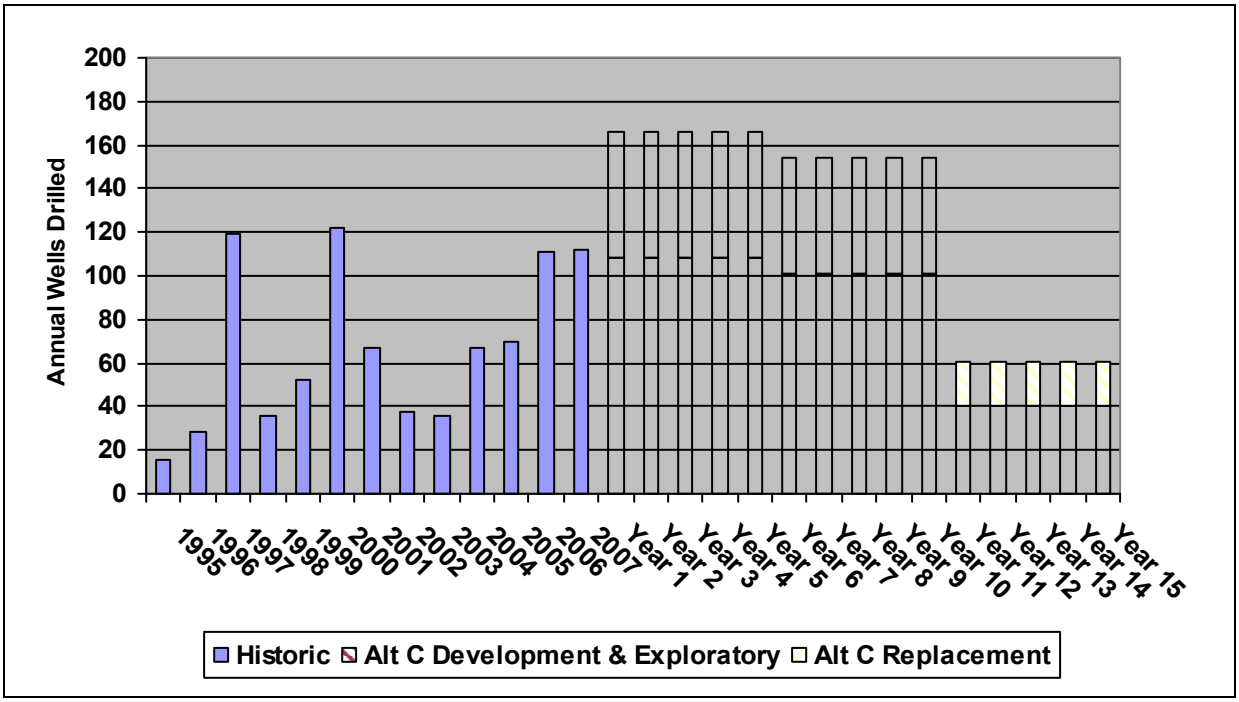
Past, present and reasonably foreseeable future actions likely to generate cumulative social and economic effects to populations within and adjacent to the BNGPA, when combined with the effects of Alternative B, are limited to natural-gas development within the area. These effects have been included in the assessment for Alternative B.

4.8.3 Alternative C—Maximum Development Alternative

Figure 4.8-13 displays recent annual drilling levels in the BNGPA and assumptions about anticipated future drilling levels associated with Alternative C. For Alternative C, this assessment assumes an annual drilling rate of 166 wells (108 development/exploratory and 58 replacement) during the first five years of development, 154 wells (101 development/exploratory and 53 replacement) during the second five years and 61 wells (40 development/exploratory and 21 replacement) during the final five years of development. The assumed Alternative C annual drilling rate of 166 wells during the first five years of development would be about 100

wells, or 60 percent higher than the 1996–2007 annual average (67 wells) and 44 wells, or 27 percent higher than the peak 2000 level of 122 wells.

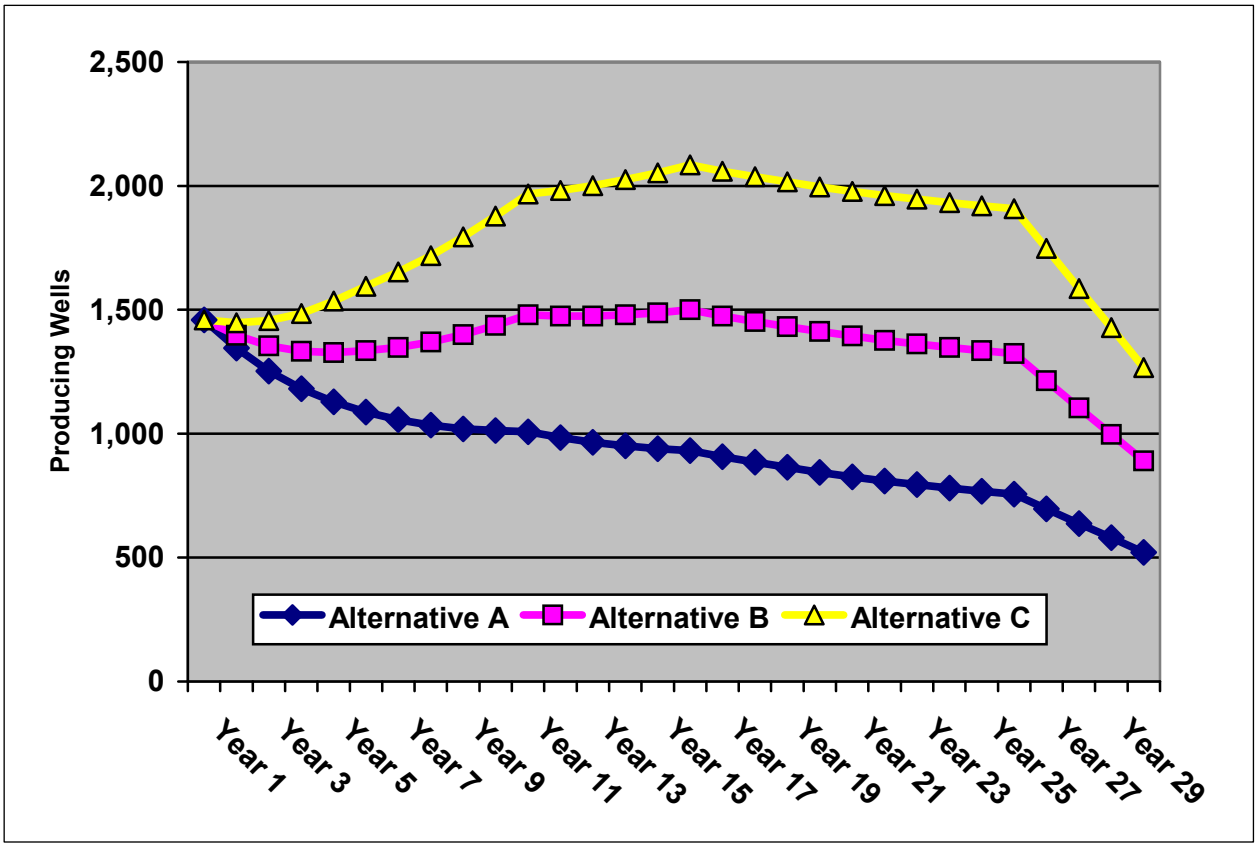
Figure 4.8-13. Historic and Alternative C Assumed Drilling Levels



Source: 1995–2005, Bowdoin Operators: 2006 & 2007 Montana board of Oil and Gas,:Year 1 – 15 are averages, prepared by BCLLC based on estimates by the Bowdoin Operators

Alternative C would result in a substantial net increase in the number of producing wells in the BNGPA, with a short-term peak near 2,100 wells in Year 16. By the end of the 30-year assessment period, the total number of producing wells would decline to 1,265, about 200 fewer than the current level, as shown in Figure 4.8-14.

Figure 4.8-14. Projected Number of Producing Wells in the BNGPA: All Alternatives

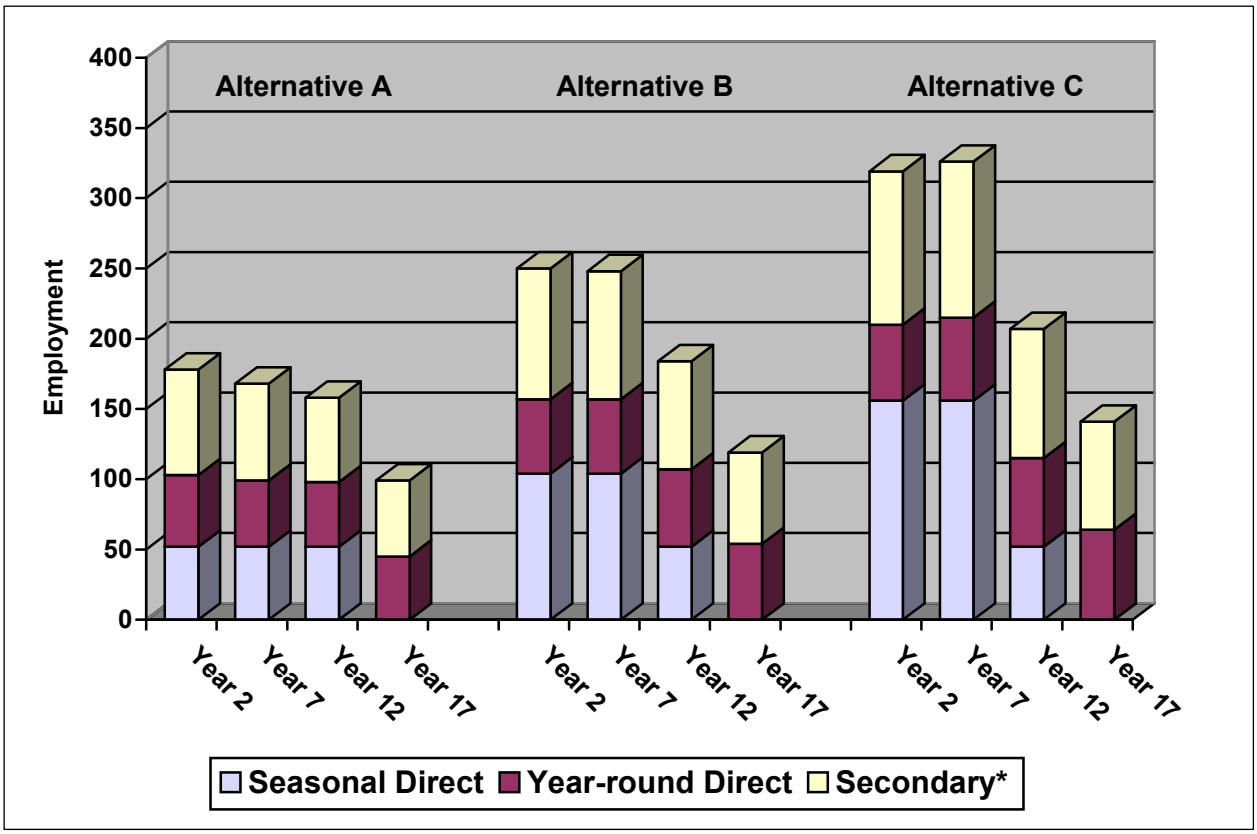


Source: Bowdoin Operators

Direct and Indirect Impacts to Employment

Alternative C would result in a substantially higher pace of drilling activity as compared to Alternatives A and B. The higher level of development associated with Alternative C would likely require the deployment of a total of three drilling rigs and completion crews during the first 10 years of development. The higher drilling/field-development activity levels associated with Alternative C would result in increased demand for gas field services and increased long-term demand for production-related and pipeline transportation services. These activities would also increase demand for other vendors and suppliers as well as for consumer goods and services. It is estimated that Alternative C would result in an incremental 336 jobs at peak (see Figure 4.8-15).

Figure 4.8-15. Estimated Total Project-Related Employment by Category: All Alternatives



* Secondary includes indirect and induced employment,
Source: BCLLC/Sammons/Dutton LLC calculations

The seasonal direct and secondary job effects are highest during the first 10 years of the assessment period due to the higher pace of assumed development. The number of such jobs declines over time under Alternative C as the pace of drilling drops to the point of only sustaining a single rig. At the beginning of the 15-year assessment period, total Alternative A employment would be about four percent of 2004 total employment in Phillips and Valley counties, falling to about one percent at the end of the 15-year assessment period.

Personal Income. As shown in Table 4.8-8, personal income associated with Alternative C would generate an estimated $210.0 million, an average of $7.2 million per year, 35 percent higher than personal income associated with Alternative A.

Table 4.8-8. Personal Income in Phillips and Valley Counties Associated With Alternatives A & C (millions of $2006)

	Year 2	Year 7	Year 12	Year 17	Total 30-Year Period	Increase Over No Action
Alternative A	$ 6.1 M	$ 5.7 M	$ 5.4 M	$ 5.2 M	$ 155.1 M	n/a
Alternative C	$ 6.9 M	$ 7.4 M	$ 7.6 M	$ 7.4 M	$ 210.0 M	35%

Direct and Indirect Impacts to Population

The increases in year-round direct and secondary employment associated with Alternative C (147–166 for the next 11 years; estimated to be about four percent of 2004 total employment for Phillips and Valley counties) would be expected to diminish the forecast reductions in population in both Phillips and Valley counties (estimated to be 8 and 14 percent, respectively, over the next 15 years). This employment would slow population loss substantially, particularly in communities near the BNGPA.

Direct and Indirect Impacts to Housing

The increase in temporary seasonal workers for drilling, completion, and field-infrastructure construction associated with Alternative C would result in a corresponding increase in demand for temporary housing in communities in and near the BNGPA. This increase should be accommodated in motels, RV parks, and mobile home parks in communities near the BNGPA (primarily Malta and Glasgow), but competition for motels and RV spaces could occur during hunting season and when the BNSF railroad is performing maintenance or constructing improvements in the area.

Direct and Indirect Impacts on Local Government Services

The increase in temporary seasonal workers is likely to increase demand for a limited range of local government services under Alternative C. As with all alternatives, county road maintenance would be the primary local government service affected by both development and operations phases of the project. The increased number of heavy trucks required to transport drilling and completion rigs, equipment and materials, and infrastructure-construction equipment and materials would increase wear and tear on county roads as would the increased number of wells requiring well maintenance and water hauling. The substantial increase in county revenues from gas production could be used to offset the costs of increased road maintenance.

Additionally, the increase in drilling, completion, and construction activity could increase demands on law enforcement, emergency response, and emergency medical services, although these increases would likely be modest.

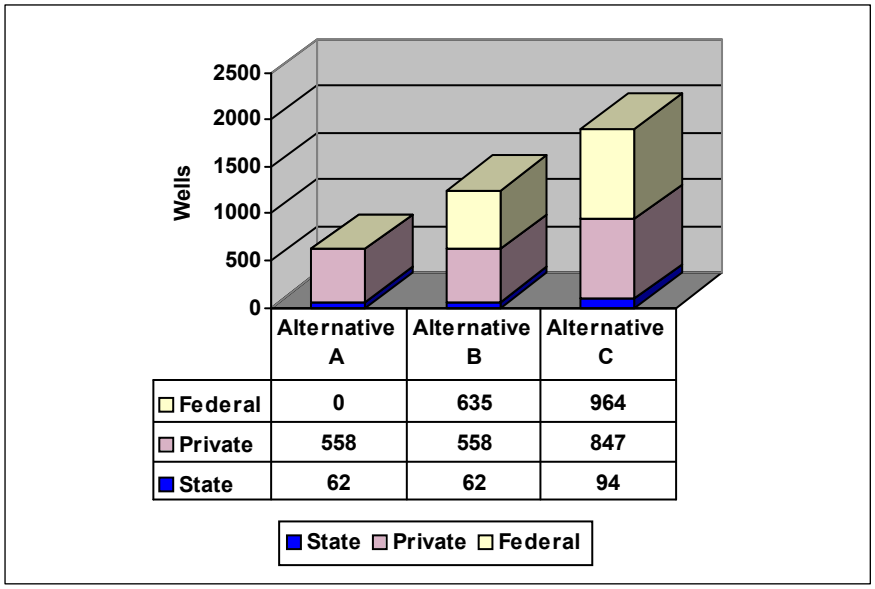
Direct and Indirect Fiscal Effects

As noted above, Alternative C-related natural-gas development and operations in the BNGPA would occur at higher levels as compared to Alternatives A and B, and therefore place correspondingly higher demand on local government services (primarily road maintenance), resulting in somewhat higher costs for local governments.

Increases in local and state government revenues under Alternative C would result from the substantially increased volumes of natural gas produced under this alternative. Also under Alternative C, local and state government would receive additional revenues from distributed

federal mineral royalty proceeds for 866 producing wells[e] as contrasted with no federal wells for Alternative A and 568 producing wells for Alternative B. Figure 4.8-16 contrasts the development assumptions by mineral estate ownership for all alternatives.

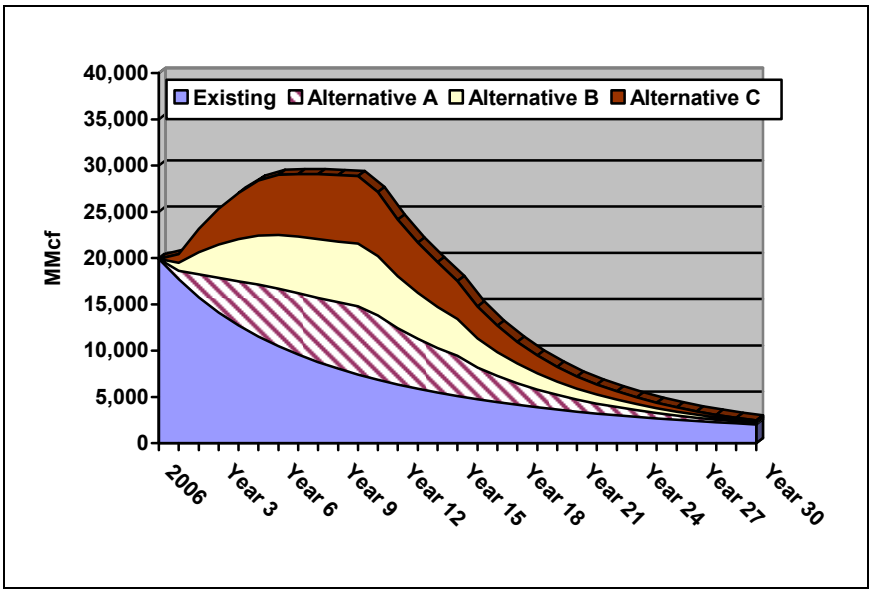
Figure 4.8-16. BNGPA Projected Wells by Mineral Ownership: All Alternatives



	Alternative A	Alternative B	Alternative C
Federal	0	635	964
Private	558	558	847
State	62	62	94

Figure 4.8-17 displays projected production from existing wells and the incremental production for all alternatives.[f]

Figure 4.8-17. Forecasted BNGPA Natural Gas Production: All Alternatives



[e] No production is assumed for exploratory wells
[f] Projected production was derived by combining typical well production data provided by the Operators, estimates of the current annual production, and the projected number of new wells.

Source: Projected production was derived by combining typical well production data provided by the Operators, estimates of the current annual production, and the projected number of new wells

Production under Alternative C, when combined with that from existing wells, would result in a temporary increase in annual production substantially above recent levels. Peak production of 29.1 Bcf (including 9.6 Bcf from existing wells) would be projected to occur in Year 7, contrasted to 16.2 BCF for Alternative A and 22.3 Bcf for Alternative B. Annual production would fall below 10 Bcf in Year 19 and to 2.4 Bcf by the end of the 30-year assessment period. Cumulative incremental production (including production from existing wells) over 30 years under Alternative C would be an estimated 479.4 Bcf compared to 290.6 Bcf under Alternative A and 380.8 Bcf under Alternative B.

Table 4.8-9 displays projected Montana Gas-production tax revenues associated with Alternatives A and C. Production associated with Alternative C and existing wells would have a cumulative value of $2,877 million over the 30-year assessment period, $1,133 million higher than Alternative A. Estimated gas-production tax revenues for Alternative C and production from existing wells would total $250.1 million, $96.4 million higher than the Alternative A production tax estimates.

Table 4.8-9. Projected Montana Gas Production Tax Revenues: Alternatives A & C

	Alternative A (Existing & Future New)	Alternative C (Existing & Future New)	Difference
Cumulative Production (MMcf)	290,627	479,432	188,805
Cumulative Production Value (@ $6.00 / Mcf)	$ 1,743.8 M	$ 2,877.0 M	$1,133.2 M
Cumulative Gas Production Tax	$ 153.7 M	$ 250.1 M	$ 96.4 M

Note: M = millions

Based on the current tax-allocation formulas, revenues totaling $115.6 million in gas production taxes would accrue to the State of Montana under Alternative C, $44.6 million higher than under Alternative A (Table 4.8-10).

Table 4.8-10. Distribution of Gas Production Taxes, 30-Year Assessment Period: Alternatives A & C

	Alternative A (Existing & Future)		Alternative C (Existing & Future)		Difference	
State of Montana	$ 71.0 M		$115.6 M		$ 44.6 M	
	Phillips County	Valley County	Phillips County	Valley County	Phillips County	Valley County
Education retirement	$ 5.3 M	$ 1.2 M	$ 8.6 M	$ 1.9 M	$ 3.3 M	$ 0.7 M
General education	$30.9 M	$ 3.2 M	$50.2 M	$ 5.2 M	$19.3 M	$ 2.0 M
County-wide transportation	$ 0.8 M	$ 0.4 M	$ 1.3 M	$ 0.6 M	$ 0.5 M	$ 0.1 M
Municipalities	$25.2 M	$ 2.1 M	$41.0 M	$ 3.4 M	$15.8 M	$ 1.3 M
County general purpose	$12.6 M	$ 1.0 M	$20.5 M	$ 1.6 M	$ 7.9 M	$ 0.6 M

Note: M = millions

Local governments and school districts in the two counties would receive combined gas-production tax revenues of $134.3 million under Alternative C; $51.6 million higher than Alternative A. About 90 percent of that total, or $121.6 million, is projected to accrue to entities in Phillips County. Projected revenues of $12.7 million would accrue to entities in Valley County under Alternative C. For both counties, local public school districts would receive the single-largest share of the gas development-related revenues; about 41 percent of the respective totals.

Federal Mineral Royalties

Under Alternative C, 964 wells would be drilled on federal leases, with 866 anticipated producing wells that would be subject to FMR.[g] Incremental FMRs under Alternative C are projected at $95.2 million, $33.2 million higher than the Alternative B estimates. There are no incremental FMR associated with Alternative A and FMRs from existing wells have not been estimated. Of the total Alternative C FMRs, an estimated $48.1 million would accrue to the federal government, $35.3 million would flow to the state, and $11.8 million would be distributed to local governments and school districts in Phillips and Valley counties.

State Royalties

Under Alternative C, 94 wells would be drilled in state-owned minerals contrasted with 62 under Alternatives A and B. The state would collect royalties on the value of the production, as well as on the value of production from existing wells on state leases. Estimated incremental state royalties, assuming a 14 percent average state royalty rate and projected production, would total about $10.4 million through 2036, about $3.5 million higher than Alternatives A and B.

Other Revenues

Royalty income for owners of private minerals would likely increase under Alternative C because 52 percent more wells are anticipated to be drilled in privately-owned minerals than under Alternatives A and B.

Incremental income taxes are not quantified in this analysis, but would be higher under Alternative C than under Alternative A or B. The revenue effects would be long-term, extending over the course of the drilling program and through the economic life of the project.

Ad valorem property taxes, also not estimated for this assessment, would similarly be higher under Alternative C than under Alternatives A or B. However, some increases in local government-service demand, particularly in the area of road maintenance, would be anticipated; therefore, somewhat higher local government-service costs would partially offset these increases in revenues. The higher employment levels associated with Alternative C would also likely help maintain demand and market prices of existing real estate, helping to sustain property tax revenues from residential and commercial real estate. These effects would be long-term.

Direct and Indirect Impacts on Social Groups

More residents of Phillips and Valley counties would experience benefits of increased economic opportunity associated with Alternative C than under Alternatives A and B. More local businesses would also be likely to experience increased sales and profits. The higher levels of direct and indirect employment associated with Alternative C (about four percent of 2004 total employment for both counties) would likely further reduce the anticipated rate of population loss

[g] No production is assumed for exploratory wells.

(8 percent for Phillips County and 14 percent for Valley County over the next 15 years) compared to the other two alternatives, particularly in communities near the BNGPA. These economic effects could result in increased well-being and quality of life for a greater number of residents of Phillips and Valley counties as compared to Alternatives A and B.

The substantial increase in local government tax revenues associated with Alternative C would likely result in either higher levels of local government services or lower tax rates for all taxpayers as contrasted with Alternatives A or B. This could result in enhanced quality of life for some residents as compared to Alternatives A and B.

The potential for split-estate conflicts would increase substantially under Alternative C, under which 47 percent more wells would be drilled into federal minerals, increasing the possibility of split-estate situations. Consequently the potential for diminished well-being and quality of life for affected ranchers and farmers would be substantially increased as compared to Alternatives A and B.

The potential for disruption or dislocation of recreation visitors (primarily hunters) and changes in the recreation setting within the BNGPA would be substantially higher under Alternative C than under Alternatives A and B, given the higher number of wells that would be drilled and the increased number of drilling, completion, and infrastructure-development crews operating during the first 10 years of development. Consequently, the potential for dissatisfaction and reductions in well-being among recreation users of the BNGPA would be increased under this alternative.

Individuals and groups who give a high priority to resource protection would have greater concerns with Alternative C as compared to Alternatives A and B because of the increased disturbance, development activity, and potential for resource impacts and environmental impacts associated with the higher drilling levels and increased production activity.

Individuals and groups who give a high priority to resource use would likely be more satisfied with Alternative C as compared to Alternatives A and B because of the substantially increased economic activity, employment, and income, and the substantially increased tax and royalty revenues. Within this broad category, some individuals and groups, particularly those that are locally based, may be less likely to believe that BMPs and additional mitigation measures would prevent environmental impacts under Alternative C, reducing support for development under this Alternative.

Environmental Justice

As with alternatives A and B, there are no racial minority environmental justice populations in the BNGPA. Although the percentage of low-income residents is about 10 percent higher in the census block group which contains most of the BNGPA than in the state as a whole, the absence of concentrations of minority and low-income populations, the low population densities and the dispersed nature of BNGPA natural gas activities would likely preclude disproportionate environmental or health effects on minority or low-income groups, if adverse environmental and health effects were to occur.

Cumulative Impacts

Past, present, and reasonably foreseeable future actions likely to generate cumulative social and economic effects to populations within and adjacent to the BNGPA, when combined with the effects of Alternative C, are limited to natural-gas development within the area. These effects have been included in the assessment for Alternative C.

4.9 SOILS

4.9.1 Introduction

Impacts resulting from construction and installation of well pads and wells, access roads, pipelines, and compressor stations include removal of vegetation and soil, exposure of soil, compaction, and undesirable mixing of soil horizons. These impacts could subsequently result in a loss of topsoil productivity, increased susceptibility of the soil to wind and water erosion, and the spread of invasive, non-native species.

4.9.2 Impact Significance Criteria

The following criteria serve as a basis to assess the intensity, duration, and magnitude of potential soil impacts associated with implementation of the Proposed Action and Alternatives. Soil impacts would be significant given the following:

- soil productivity is reduced to a level that prevents the disturbed area from recovering to pre-disturbance soil/vegetation productivity levels;
- interim reclamation is not successful within two to five years of implementation;
- vegetation significance criteria are not met;
- water resources significance criteria are not met.

4.9.3 Alternative A—No Federal Action

Direct and Indirect Impacts

Under the No Federal Action Alternative, construction and operation of private and state wells and associated pipelines, access roads, and facilities in the BNGPA would result in direct and indirect impacts to the soil resource. These impacts would include removal of topsoil and vegetation, soil compaction, mixing of soil horizons, exposure of soil, loss of soil productivity, increased susceptibility of the soil to wind and water erosion, and increased potential for invasive, non-native species to become established.

Over the estimated 10 to 15-year drilling period, Alternative A is estimated to initially disturb a total of 1,312 acres. This total would include 620 acres for well pads (620 wells at 1 acre per well pad), 377 acres for pipelines, 12 acres for 4 new compressor stations, and 301.8 acres for access roads. The total area of disturbance would comprise approximately 0.16 percent of the 813,000-acre project area.

Once a well goes into production, the size of the well pad can be reduced to approximately 0.5 acres. The remaining area of initial disturbance on the well pad would be reclaimed as described in section 2 and in **Appendix D—Reclamation Plan**. All pipeline disturbances would be reclaimed as soon as installation is complete. Assuming all wells are productive, upon successful reclamation, the total area of impact would be reduced to approximately 624 acres, including 310 acres for well pads, 301.8 acres for roads, and 12 acres for compressor stations. These long-term disturbance areas would represent approximately 0.077 percent of the total project area.

The soils assessment conducted in Chapter 3 ranked the project area soils for potential limitations to wind and water erosion, and reclamation success (Table 3.9-1). Sixteen percent of the BNGPA has a severe hazard for water erosion, 0.19 percent of the project area is considered to have a severe hazard for wind erosion, and 15 percent of the BNGPA has poor

reclamation potential. Because exact locations of planned disturbances are unknown, it will be assumed that soils, and their corresponding potential limitations, in those disturbance areas are distributed in the same proportion as across the entire project area. Therefore, for the 1,312 acres of initial disturbance, this translates to 207 acres with a severe hazard for water erosion, 2.8 acres with a severe hazard for wind erosion, and 199 acres with poor reclamation potential. Given the total approximate size of the BNGPA—813,000 acres—significant impacts are not expected to occur with implementation of Alternative A.

The soils assessment in Chapter 3 also included an evaluation of the capacity of the soil to support vehicle traffic during drilling and completion activities, and during production activities. The evaluation was conducted for wet-season conditions. Roads constructed on soils that cover 28 percent of the project area are considered to have poor vehicle trafficability when used for wet-season drilling and completion activities. Roads constructed on soils that cover 24 percent of the project area are considered to have poor vehicle trafficability when used for wet-season production operations. Assuming that soils, and their corresponding potential limitations, are distributed in road construction areas in the same proportion as across the entire project area, under Alternative A, 85 acres or 58 miles of new and existing roads would be considered to have poor vehicle trafficability for use during wet-season drilling and completion operations. For new and existing roads used during production operations, 71 acres or 49 miles would be considered to have poor vehicle trafficability during the wet season. To prevent or minimize these impacts, vehicle traffic should only be allowed on BNGPA roads during dry or frozen conditions. Alternatively, roads could be improved in areas with high traffic-use patterns.

Cumulative Impacts

The No Federal Action Alternative combined with an existing disturbance of 778 acres related to current well pads and compressor stations would result in a cumulative disturbance of approximately 2,089 acres or 0.26 percent of the 813,000-acre project area. Once successful reclamation of short-term disturbances is completed for Alternative A, long-term disturbances would comprise a total cumulative impact of 1,401 acres, or 0.17 percent of the project area. However, BMPs and mitigation measures will be implemented to minimize impacts (see **Appendix D—Reclamation Plan**).

4.9.4 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts

The Proposed Action is the same as the No Federal Action Alternative except that an additional 635 federal wells and their associated infrastructure would be developed. Over the estimated 10 to 15-year drilling period, Alternative B is estimated to initially disturb a total of 2,646 acres. This total would include 1,255 acres for well pads (1,255 wells at 1 acre per well pad), 762 acres for pipelines, 12 acres for four new compressor stations, and 609.1 acres for access roads. The total area of disturbance would comprise approximately 0.33 percent of the 813,000-acre project area.

Following completion of successful reclamation of pipeline areas and the drilling area of the well pads, the total area of impact would be reduced to approximately 1,249 acres, including 628 acres for well pads (1,255 wells at 0.5 acres per well pad), 609.1 acres for roads, and 12 acres for compressor stations. These long-term disturbance areas would represent approximately 0.15 percent of the total project area.

Using potential soil limitation information from Table 3.9-1, and the assumption that soils are distributed across the disturbance areas in the same proportion as across the entire project

area, for the 2,646 acres of initial disturbance, 417 acres would have a severe hazard for water erosion, 5.2 acres would have a severe hazard for wind erosion, and 401 acres would have poor reclamation potential. Given the total size of the BNGPA—813,000 acres—significant impacts are not expected to occur with implementation of Alternative B.

With regard to vehicle trafficability, assuming that soils, and their corresponding potential limitations, are distributed in road construction areas in the same proportion as across the entire project area, under Alternative B, 171 acres or 118 miles of new and existing roads would be considered to have poor vehicle trafficability for travel during wet season drilling and completion operations. For new and existing roads used during production operations, 143 acres or 99 miles would be considered to have poor vehicle trafficability during the wet season. To prevent or minimize these impacts, vehicle traffic should only be allowed on BNGPA roads during dry or frozen conditions. Alternatively, roads could be improved in areas with high traffic-use patterns.

Cumulative Impacts

The Proposed Action combined with an existing disturbance of 778 acres related to current well pads and compressor stations would result in a cumulative disturbance of approximately 3,424 acres or 0.42 percent of the 813,000-acre project area. Once successful reclamation of short-term disturbances is completed for Alternative B, long-term disturbances would comprise a total cumulative impact of 2,026 acres, or 0.25 percent of the project area. However, BMPs and mitigation measures will be implemented to minimize impacts (see **Appendix D—Reclamation Plan**).

4.9.5 Alternative C—Maximum Development Alternative

Direct and Indirect Impacts

The Maximum Development Alternative is the same as the No Federal Action Alternative except that an additional 964 federal wells, 289 private wells, and 32 state wells and their associated infrastructure would be developed. Over the estimated 10 to 15-year drilling period, Alternative C is estimated to initially disturb a total of 3,998 acres. This total would include 1,905 acres for well pads (1905 wells at 1 acre per well pad), 1,156 acres for pipelines, 12 acres for 4 new compressor stations, and 925.1 acres for new access roads. The total area of disturbance would comprise approximately 0.49 percent of the 813,000-acre project area.

Following completion of successful reclamation of pipeline areas and the drilling area of the well pads, the total area of impact would be reduced to approximately 1,890 acres, including 953 acres for well pads (1,905 wells at 0.5 acres per well pad), 925.1 acres for roads, and 12 acres for compressor stations. These long-term disturbance areas would represent approximately 0.23 percent of the total project area.

Using potential soil limitation information from Table 3.9-1, and the assumption that soils are distributed across the disturbance areas in the same proportion as across the entire project area, for the 3,998 acres of initial disturbance, 630 acres would have a severe hazard for water erosion, 7.8 acres would have a severe hazard for wind erosion, and 606 acres would have poor reclamation potential. Given the total size of the BNGPA—813,000 acres—significant impacts are not expected to occur with implementation of Alternative C.

With regard to vehicle trafficability, assuming that soils and their corresponding potential limitations are distributed in road construction areas in the same proportion as across the entire project area, under Alternative C, 260 acres or 179 miles of new and existing roads would be considered to have poor vehicle trafficability for use during wet-season drilling and completion

operations. For new and existing roads used during production operations, 218 acres or 150 miles would be considered to have poor vehicle trafficability during the wet season. To prevent or minimize these impacts, vehicle traffic should only be allowed on BNGPA roads during dry or frozen conditions. Alternatively, roads could be improved in areas with high traffic-use patterns.

Cumulative Impacts

The Maximum Development Alternative combined with an existing disturbance of 778 acres related to current well pads and compressor stations would result in a cumulative disturbance of approximately 4,776 acres or 0.59 percent of the 813,000-acre project area. Once successful reclamation of short-term disturbances is completed for Alternative C, long-term disturbances would comprise a total cumulative impact of 2,667 acres, or 0.33 percent of the project area. However, BMPs and mitigation measures would be implemented to minimize impacts (see **Appendix D—Reclamation Plan**).

4.9.6 Impacts Summary

Soil impacts are similar for all three alternatives, with the only variation being the amount of the disturbance. For Alternative A, No Federal Action, the total area of disturbance is estimated to be 1,312 acres, which would comprise approximately 0.16 percent of the 813,000-acre project area. For Alternative B, the Proposed Action, the total area of disturbance is estimated to be 2,646 acres, which would comprise approximately 0.33 percent of the 813,000-acre project area. Finally, for Alternative C, Maximum Development Alternative, the total area of disturbance is estimated to be 3,998 acres, which would comprise approximately 0.49 percent of the 813,000-acre project area. Because of the small relative size of the affected areas, no significant impacts are expected to occur with any of the alternatives. Impacts related to vehicle use of roads during wet conditions can be prevented or minimized by only allowing vehicle traffic access during dry or frozen conditions.

4.9.7 Mitigation Measures

Because of the limited extent of soils with severe water and wind erosion hazard and poor reclamation potential, when at all possible, development should be avoided on these areas. Development would be avoided on areas where erosion cannot be effectively controlled/mitigated and reclamation to BLM standards is likely to be unsuccessful. To prevent or minimize impacts caused by vehicle travel on wet roads, vehicle traffic should only be allowed on BNGPA roads during dry or frozen conditions. Alternatively, roads could be improved in areas with high traffic-use patterns.

4.9.8 Residual Impacts

No residual impacts to soils would occur due to the Proposed Action or any of the alternatives, assuming reclamation and erosion control is successful.

4.10 ACCESS AND TRANSPORTATION

4.10.1 Alternative A—No Federal Action

Alternative A assumes an annual drilling rate of 54 wells during the first five years of development, 50 wells during the second five years and 20 wells during the final five years of development. This annual drilling rate of 54 wells would be lower than the 1996–2005 annual

average (65.5 wells) and less than the 2005 drilling level (64 and 70, respectively). Alternative A assumes that one rig operating in the field would be able to achieve this annual drilling schedule.

As described in section **3.10**, **Transportation and Access**, drilling, completion, and field-infrastructure development trips would occur during July through November of each year. Under Alternative A, it is likely that one drilling rig and associated gathering-system construction equipment would mobilize to the BNGPA and remain there for the duration of the drilling season, moving from location to location within the BNGPA to drill, complete, and connect wells to the gathering system. Trips associated with transporting drilling, completion, and gathering system/field-infrastructure construction crews to and from lodging and with trucks hauling fuel, materials, and equipment to supply these crews would occur daily on a variety of federal, state, county, BLM, and private roads, depending on the location of the wells under development. Consequently, comparably high volumes of truck and passenger-vehicle traffic would occur on a variety of routes during each drilling season, but these periods of comparatively high volume would be short-term, temporary, and dispersed to different locations within the BNGPA.

Direct and Indirect Impacts

A more constant but lower volume of trips would be associated with well-field and pipeline production and maintenance and with the hauling of produced water to disposal sites, also described in section 3.10. Well and pipeline production and maintenance-related trips would be fairly low in volume (each well is visited on a schedule ranging from twice a week to once every two weeks). Water hauling would be required for about 25 percent of the wells in the BNGPA. Water haulers collect water from two to five wells per day and make one to two trips to produced-water disposal ponds each day; consequently, roads providing access to these ponds would experience frequent use.

Federal and State Highways. The MDT traffic counts presented in Table 3.10-2 include historic BNGPA drilling and operations traffic. Under Alternative A, annual drilling levels and the number of producing wells would both be lower than the annual average of the previous 10 years, requiring fewer BNGP-related trips over the course of a year, and thus requiring fewer drilling and production-related trips. However, water production at wells using electric pumps is likely to increase, requiring additional produced-water disposal-related trips. Produced-water disposal trips occur primarily within the BNGPA on county and BLM roads; consequently, BNGP-related annual traffic on federal and state highways would be reduced as compared to the past 10 years, and would contribute less to any change in levels of service on these highways.

County Roads. The lower annual drilling levels associated with Alternative A would result in fewer drilling, completion, and infrastructure construction-related trips on county roads as compared to the annual average for the last 10 years. These reductions in traffic would be the result of a shorter drilling/field-development season; during this shorter annual season the daily number of trips would be similar to the recent past. This reduction in drilling/field-development traffic would result in corresponding reductions in wear and tear on county roads and hence reduce county road maintenance requirements. Similarly, the decline in producing wells associated with Alternative A would result in a corresponding reduction in well maintenance and water-hauling trips, further reducing county road maintenance demand. The decline in traffic associated with producing wells would be offset by increased water production in some wells, which would increase as the gas pressure decreases. The counties would experience reductions in their share of gas-production tax revenues and revenues from federal mineral royalties resulting from the reduced number of producing wells in the BNGPA reducing the amount of revenue available for road maintenance under Alternative A.

BLM Roads. BLM roads which provide access to private or state-owned minerals would also experience lower drilling/field-development traffic under Alternative A as compared to the recent past. BLM roads to existing wells would also experience reductions in traffic as the number of operating wells diminishes. These reductions in BNGPA traffic would correspondingly reduce BLM road maintenance requirements.

Roads on State Lands. Under Alternative A an estimated 207.5 miles of new and existing two-track roads would be used to access new wells and 62 wells, or 10 percent, of total wells would be located on state-owned lands. Therefore, on a proportional basis, an estimated 20.7 miles of new or existing two-track roads would be required for well and pipeline access on state lands. Operators would be required to maintain new and existing roads used for well and pipeline access on state lands, resulting in little incremental cost for state government. The state would also receive gas-production tax revenues and lease revenues from wells on state-owned lands.

Roads on Private Lands. Wells in private minerals total 90 percent of all wells associated with Alternative A, therefore, on a proportional basis, an estimated 186.7 miles of new roads and existing two-track roads would be required to access new wells under this alternative. However, until well pads are sited for new wells, the exact number and length of new access roads on private lands cannot be estimated.

New roads on private lands can provide new access for land-owners; however, new roads and gas-field traffic also have the potential to create noise and visual intrusions and alter grazing and other agricultural uses of the land. Operators would be required to maintain new and existing roads on private lands used for well and pipeline access.

Cumulative Impacts

No past, present, or reasonably foreseeable future actions have been identified which, when combined with the effects of Alternative A, would result in cumulative access or transportation impacts in the BNGPA.

4.10.2 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts

Alternative B assumes an annual drilling rate of 110 wells during the first five years of development, 101 wells during the second five years, and 41 wells during the final five years of development. The Alternative B annual drilling rate would be higher during the first 10 years than the 1996–2005 annual average (65.5 wells), but lower than the peak drilling years of 1997 (119 wells) and 2000 (122 wells).

Alternative C further assumes that two drilling and completion rigs and gathering system construction crews would be required to achieve the Alternative B drilling rate during the first 10 years, effectively doubling the number of drilling/field-development trips for at least a portion of the annual July through November drilling season.

Year-round gas-field and pipeline maintenance-related trips would likely fall until about 2016 under the Alternative B annual drilling assumptions, as the number of wells in production would decline faster than they would be replaced by new wells. From about 2016–2025, the number of operating wells would be about the same as the current level, peaking at about 1,500 wells in 2022, about 40 wells higher than the current number of producing wells. During the 2016–2025 period, the well field and production-related traffic would be about the same as current levels.

Federal and State Highways. Under Alternative B, annual drilling levels would be higher during the first 10 years than the annual average of the past 10 years. Consequently, BNGP-related annual traffic on federal and state highways providing access to the BNGPA would be increased, but unlikely to affect the level of service on these highways given the season of operation, the temporary and short-term nature of the drilling/field-development season, the dispersed nature of the drilling and field development activities within the BNGPA, and the relatively small portion of total trips this traffic represents on federal and primary state highways. The increase in traffic would be more substantial for secondary state highways such as MT 208, MT 243 and MT 537, but these increases would likely be temporary and short-term during any one drilling/field-development season.

As noted above, year-round production-related trips would decrease in the near term, increase to about current levels between 2016 and 2025, and then decline through the productive life of the field.

County Roads. The higher annual drilling levels associated with Alternative B would result in an increase in drilling, completion, and gathering system/well-field infrastructure construction-related trips on county roads, as compared to Alternative A and to the annual average for the last 10 years. This increase in drilling/field-development traffic would result in corresponding increases in wear and tear on county roads and hence increase county road maintenance requirements.

Conversely, the number of producing wells in the BNGPA is anticipated to decrease in the near term under Alternative B, resulting in a corresponding decrease in well-maintenance and water-hauling trips, decreasing that aspect of county road maintenance demand.

Offsetting the drilling/field-development increases in road maintenance demand would be corresponding increases in the counties' share of gas-production tax revenues including that portion of gas-production tax dedicated to county road maintenance (an estimated $1.5 million under Alternative B for both counties as compared to $1.2 million under Alternative A) and the counties' general-purpose share of production tax revenues ($17.7 million for both counties under Alternative B compared with $13.6 million under Alternative A). The counties would also receive additional revenues from federal mineral royalties, given that the incremental wells associated with Alternative B would all be wells in federal minerals as contrasted with Alternative A, which would allow no new wells in federal minerals.

BLM Roads. Traffic on BLM roads that provide access to private or state-owned minerals would experience similar traffic levels under Alternatives A and B, given that the number of wells drilled in private and state minerals are the same for these two alternatives. However, under Alternative B, 635 wells would be drilled in federal minerals, increasing traffic and maintenance requirements on BLM roads providing access to some of these wells (some are likely to be located beneath private surface) and increasing the number of well access roads by 217.25 miles over Alternative A. New and existing two-track roads providing access to Alternative B wells in federal minerals could occur on federal or private surface, depending on surface ownership.

Roads on State Lands. The number and length of existing and new roads used to access wells in state-owned minerals would be the same for Alternatives A and B. Road maintenance requirements for roads on state lands would also be the same for Alternatives A and B.

Roads on Private Lands. Although the number of wells drilled in privately-owned minerals would be the same for Alternatives A and B, the number of existing and new roads on private lands would likely increase because a portion of the wells in federal minerals are likely to be in split estate situations where the surface is in private ownership. Therefore the number of miles of road on private lands cannot be calculated until well pads are sited.

The types of potential road impacts to private lands would be the same under Alternatives A and B, but the number and length of roads on private lands, the traffic volumes and the number of affected land-owners is likely to increase.

Cumulative Impacts

No past, present or reasonably foreseeable future actions have been identified which, when combined with the effects of Alternative B, would result in access or transportation impacts in the BNGPA.

4.10.3 Alternative C—Maximum Development Alternative

Alternative C assumes an annual drilling rate of 166 wells during the first five years of development, 154 wells during the second five years, and 61 wells during the final five years of development. The assumed Alternative C annual drilling rate of 166 wells during the first five years of development would be 100 wells or 153 percent higher than the 1996–2005 annual average (65.5 wells) and 44 wells or 36 percent higher than the peak 2000 level of 122 wells. Alternative C assumes that this annual drilling schedule would require three drilling rigs during the first 10 years.

The use of three drilling rigs and associated completion and gathering system construction crews under Alternative C would increase the BNGP-related drilling/field-development traffic during July through November by about 200 percent during the first 10 years of development.

Under Alternative C, well-field and pipeline-maintenance traffic would also increase as the number of producing wells in the field would increase to a peak of 2,084 wells in 2022, which would be 43 percent higher than the current level. The number of producing wells and associated trips would then decline through the productive life of the field.

Direct and Indirect Impacts

Federal and State Highways. Under Alternative C, annual drilling levels would be substantially higher during the first 10 years than the annual average of the past 10 years. Well-field and pipeline-maintenance trips would also increase through 2022. Consequently, BNGPA-related annual traffic on federal and primary state highways providing access to the BNGPA would be increased, but unlikely to affect the level of service on these highways given the relatively small portion of total trips this traffic represents. The relative increase in traffic would be more substantial for secondary state highways such as MT 208, MT 243 and MT 537, particularly if more than one rig would be drilling in the same general area at the same time. Again, these increases would likely be temporary and short-term during any one drilling/field-development season.

County Roads. The substantially higher annual drilling levels associated with Alternative C would result in a corresponding substantial increase in drilling, completion, and infrastructure construction-related trips on county roads, as compared to Alternative A and to the annual average for the last 10 years. This substantial increase in drilling/field-development traffic would result in corresponding increases in wear and tear on county roads and hence increase county

road maintenance requirements substantially as compared to Alternative A. Similarly, the number of producing wells in the BNGPA would be substantially increased under Alternative C, resulting in a corresponding increase in well maintenance and water hauling trips, further increasing county road maintenance demand. Offsetting these increases in road maintenance demand would be corresponding increases in the counties' share of gas-production tax revenues dedicated to road maintenance ($1.9 million for both counties under Alternative C compared to $1.2 million for Alternative A) and the counties' general-purpose share of production tax revenues ($22.1 million for both counties under Alternative C compared with $13.6 million under Alternative A). The counties would also receive substantial additional revenues from FMRs, given that incremental wells associated with Alternative C would include 964 wells in federal minerals, as contrasted with Alternative A, which includes no wells in federal minerals.

BLM Roads. Traffic on BLM roads that provide access to private or state-owned minerals would experience substantially higher traffic levels under Alternative C, given that the number of wells drilled in private and state minerals would both increase by about 50 percent over Alternative A levels.

Under Alternative C, 964 wells would be drilled in federal minerals, increasing traffic on BLM roads that provide access to these wells and increasing the number of well-access roads by an estimated 318 miles over Alternative A. New and existing two-track roads providing access to Alternative C wells in federal minerals could occur on federal or private surface, depending on surface ownership.

Roads on State Lands. The number and length of existing and new roads used to access wells in state-owned minerals would be an estimated 31.2 miles under Alternative C, about 50 percent higher than under Alternative A. Alternative C would increase maintenance demands for roads on state surface but also increase state revenues as contrasted with Alternative A.

Roads on Private Lands. Under Alternative C, the number of wells drilled in privately owned minerals would increase to 847, about 52 percent higher than under Alternative A. Consequently the number of existing and new roads on private lands would also increase substantially. Additionally, a portion of the wells in federal minerals are likely to in split estate situations where the surface is in private ownership. Therefore, the number of miles of road on private lands cannot be calculated until well pads are sited.

The types of potential road impacts to private lands would be the same under Alternative C as compared to Alternative A, but the number and length of roads on private lands is likely to increase substantially under Alternative C, as is the volume of traffic.

Cumulative Impacts

No past, present, or reasonably foreseeable future actions have been identified which, when combined with the effects of Alternative C, would result in access or transportation impacts in the BNGPA.

4.11 VEGETATION

4.11.1 Alternative A—No Federal Action

Direct and Indirect Impacts

Disturbance caused from drilling and construction of access roads, pipeline corridors, and compressor sites initially would remove vegetation from approximately 1,312 acres in the BNGPA. Compaction by equipment traffic would damage vegetation and affect productivity. Vegetative productivity would be restored through reclamation and elimination of vehicle travel. Certified weed-free seed mixtures used in reclamation would be determined by the surface owner or the surface-management owner. It would be expected that approximately 624 acres of vegetation would remain disturbed during the production phase of the project.

Wetland and Riparian Areas. Surface disturbance associated with Alternative A would be confined to private and state lands. Over 13,391 acres (39.8 percent) and 2,260 acres (6.7 percent) of wetlands occur on private and state-administered lands, respectively. Wetlands acreage on private and state lands constitutes 1.6 percent and 0.3 percent of total acreage within the BNGPA, respectively. Vehicle traffic through wetland and riparian areas could damage sensitive vegetation. Project activities also could result in a temporary increase in turbidity (water quality deterioration). Water-quality impacts also could occur as a result of increased runoff and erosion initiated by surface disturbance on floodplains or higher land near drainage channels. Vehicle traffic through waterbodies also could result in an increase in turbidity; vehicle crossings should be made at existing fords. Impacts are expected to be negligible if existing crossings are used. Because water courses serve as major corridors for the transport and dispersal of invasive non-native species, any soil-surface disturbance in riparian areas should be monitored closely to prevent establishment of invasive/noxious weeds. Alternative A is not expected to significantly affect any wetland or riparian areas.

Invasive, Non-native Species. Surface disturbance associated with construction of proposed well pads, access roads, pipelines, and compressor sites would present opportunities for weed invasion and spread. Under Alternative A, 1,312 acres would receive varying degrees of surface disturbance that promotes the establishment of invasive, non-native plant species. Implementation of activities under Alternative A would create a favorable environment for the establishment and spread of noxious weeds/invasive plants, such as spotted knapweed, diffuse knapweed, Russian knapweed, leafy spurge, Canada thistle, and hoary cress in areas of surface disturbance. Surface-disturbing activities under Alternative A would increase the potential for infestation and spread of spread of Category 1, 2, and/or 3 invasive, non-native species, throughout the BNGPA. Invasive non-native species usually thrive on newly disturbed surfaces after removal of existing vegetation, and have the ability to out-compete many native plant species. Construction equipment, vehicles, and mobile facilities traveling from weed-infested areas can facilitate the spread of noxious weeds into previously weed-free areas. After successful reclamation, an estimated 624 acres would remain impacted for the life of the project. Areas without successful reclamation and areas impacted for the life of the project would be prone to the establishment and infestation of invasive, non-native plant species. However, implementation of measures proposed in the BNGPA to control noxious weeds would ensure that potential impacts from noxious weeds and invasive plants would be minimal.

Cumulative Impacts

Construction under Alternative A would have temporary to long-term impacts on vegetation. Removal of vegetation and disturbance of soils during construction would create favorable

conditions for the invasion and establishment of invasive, non-native species that could continue for many years after the initial disturbance. Implementation of Alternative A would have a cumulative impact on vegetation; however, the amount of vegetation that would be disturbed would be less than the amount disturbed by either Alternative B or Alternative C. Cumulative impacts would be minimized by employing measures for the proper handling of topsoil and spoil, erosion control, preventative and remedial noxious weed management, and reestablishment of desirable vegetation for any additional project in the area for the reasonably foreseeable future.

4.11.2 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts

Disturbance caused from drilling and construction of access roads, pipeline corridors, and compressor sites initially would remove vegetation from approximately 2,646 acres in the BNGPA. Potential impacts to vegetation on private and state lands essentially would remain the same as Alternative A. The majority of additional disturbance under the Proposed Action would occur on federal lands. It would be expected that approximately 1,249 acres of vegetation would remain disturbed during the production phase of the project.

Wetland and Riparian Areas. Surface disturbance associated with Alternative B would occur on private, state, and federal lands throughout the BNGPA. Approximately 16,087 (47.8 percent), 13,391 acres (39.8 percent), and 2,260 acres (6.7 percent) of wetlands occur on federal, private, and state-administered lands, respectively. Wetlands acreage on private and state lands constitutes 2.0 percent, 1.6 percent, and 0.3 percent of total acreage within the BNGPA, respectively. Impacts due to the Proposed Action would be similar to those described for Alternative A. The potential for impacts to occur is higher under implementation of the Proposed Action than under Alternative A because approximately twice as much surface disturbance is expected to occur. Although the potential for impacts to occur will increase, the Proposed Action is not expected to significantly affect any wetland or riparian areas.

Invasive, Non-native Species. Impacts due to the Proposed Action would be similar to those described for Alternative A. Under the Proposed Action, 2,646 acres would receive varying degrees of surface disturbance that promotes the establishment of invasive, non-native plant species. After successful reclamation, an estimated 1,249 acres would remain impacted for the life of the project. The potential for impacts to occur is higher under implementation of the Proposed Action than under Alternative A because approximately twice as much surface disturbance is expected to occur. However, implementation of measures proposed in the BNGPA to control noxious weeds would ensure that potential impacts from noxious weeds and invasive plants would be minimal.

Cumulative Impacts

Cumulative impacts due to the Proposed Action would be similar to those described for Alternative A. Implementation of the Proposed Action would have a cumulative impact on vegetation; however, the amount of vegetation that would be disturbed would be more than the amount disturbed by Alternative A and less than Alternative C. Cumulative impacts would be minimized by employing measures for the proper handling of topsoil and spoil, erosion control, preventative and remedial noxious weed management, and reestablishment of desirable vegetation for any additional project in the area for the reasonably foreseeable future.

4.11.3 Alternative C—Maximum Development Alternative

Direct and Indirect Impacts

Disturbance caused from drilling and construction of access roads, pipeline corridors, and compressor sites initially would remove vegetation from approximately 3,998 acres in the BNGPA. Potential impacts to vegetation under Alternative C would be greater than those described under Alternative A and B. Additional disturbance under Alternative C would increase and occur proportionately on federal, private, and state-administered lands in comparison to impacts discussed for the Proposed Action. It would be expected that approximately 1,890 acres of vegetation would remain disturbed during the production phase of the project.

Wetland and Riparian Areas. Surface disturbance associated with Alternative C would occur on private, state, and federal lands throughout the BNGPA. Impacts due to Alternative C would be similar to those described for Alternative A. The potential for impacts to occur would be higher under implementation of Alternative C than under Alternative A because more than three times as much surface disturbance is expected. The potential for impacts to occur would be higher under implementation of Alternative C than under the Proposed Action because approximately 50 percent more surface disturbance is expected to occur. Although the potential for impacts to occur is highest under Alternative C, any effects to wetland or riparian areas are expected to be negligible.

Invasive, Non-native Species. Impacts due to the Alternative C would be similar to those described for Alternative A. Under Alternative C, 3,998 acres would receive varying degrees of surface disturbance that promotes the establishment of invasive, non-native plant species. After successful reclamation, an estimated 1,890 acres would remain impacted for the life of the project. The potential for impacts to occur would be higher under implementation of Alternative C than under Alternative A because more than three times as much surface disturbance is expected to occur. The potential for impacts to occur would be higher under implementation of Alternative C than under the Proposed Action because approximately 50 percent more surface disturbance is expected to occur. However, implementation of measures proposed in the BNGPA to control noxious weeds would ensure that potential impacts from noxious weeds and invasive plants would be minimal.

Cumulative Impacts

Potential cumulative impacts due to Alternative C would be similar to those described for Alternative A. Implementation of Alternative C would have a cumulative impact on vegetation; the amount of vegetation disturbed would be twice the amount disturbed by Alternative A, and 50 percent more than Alternative B. Cumulative impacts would be minimized by employing measures for the proper handling of topsoil and spoil, erosion control, preventative and remedial noxious weed management, and reestablishment of desirable vegetation for any additional project in the area for the reasonably foreseeable future.

4.12 WILDLIFE

4.12.1 Alternative A—No Federal Action

Direct and Indirect Impacts

Direct and indirect impacts to wildlife species and their habitats would vary depending upon the requirements of each species and the existing habitat present. Development activities could

affect wildlife through habitat loss, alteration, and fragmentation, as well as through disturbance, displacement, and mortality. Direct impacts to wildlife could include mortalities resulting from collisions with vehicles and power lines; electrocution from power lines; removal of existing vegetation and the resulting loss of cover, nesting, and foraging habitat; and deaths in production ponds. The increase in vehicle traffic would result in an increase in collision-related mortalities to all wildlife species. The most notable species impacted include big game, upland and passerine birds, waterfowl, small mammals, and reptiles and amphibians. These additional mortalities would not have a noticeable impact on the local populations of the species affected. Habitat loss could result in reduced productivity and, in rare cases, increased stress-related mortality within wildlife populations. The degree of impact would depend on the type of habitat affected and the regeneration rate of vegetation after construction. Herbaceous vegetation would be likely to reestablish within one to two years, silver sage in one to two years, big sage in 25-75 years, and buffaloberry possibly never.

Indirect impacts would include habitat fragmentation and wildlife displacement. Development activities also could result in the displacement of wildlife from areas in or adjacent to development areas. Reproductive success and nutritional condition could decrease due to increased energy expenditures that result from physical response to disturbance. Displaced animals may relocate into similar habitats nearby; however, the reduced availability of habitat could increase intra- and inter-specific competition and could lower reproductive success and survival. Displacement would be a temporary impact because animals probably would return to disturbance areas after construction activities are complete and the habitat is reclaimed. Appropriate fencing would be required to ensure that animals do not become trapped within reserve pits, evaporation ponds, produced-water pits, or other potentially hazardous sites. The species most impacted by habitat fragmentation include those with larger home ranges, such as big game, upland game birds, and raptors.

Development under Alternative A would result in the direct loss of 1,312 acres of habitat initially, and the direct loss of 624 acres of habitat for the estimated life of the project. Some disturbed habitats, along pipeline rights-of-way for example, would be reclaimed soon after initial disturbance; others would remain disturbed for the life of the project. Well locations, pipeline rights-of-way, roads, and compressor sites should be designed with reclamation as an objective. Successful reclamation would stabilize disturbed sites and attempt to restore disturbed areas to pre-disturbance conditions. Reclamation would not always recreate pre-disturbance values. Changing native grassland prairies or sagebrush steppe to an environment characterized by non-native grass species, invasive and noxious weed species, or early-seral species would affect mixed grassland prairie specialists or sagebrush obligates by reducing vital habitat and forage. However, habitat loss is not expected to affect the long term viability of these specialist species due to the small amount of acres impacted relative to the size of the BNGPA. Impacts to wildlife species would be minimized by implementing the following general BLM mitigation measures:

- Minimize new road construction and maximize reclamation of disturbed areas.
- Gate roads as specified by BLM to discourage public use and reduce disturbance.
- Prevent vehicle use of pipeline rights-of-way.
- Locate pipelines adjacent to roads to the greatest extent possible.
- Design facilities with reclamation as an objective.
- Consolidate facilities whenever possible to minimize fragmentation of habitats.

Big Game Species: Direct impacts on big game would include direct habitat loss and displacement from development. In addition, increased traffic volumes on roads within and near the BNGPA could cause increased big game mortalities from collisions with vehicles. Pronghorn, in particular, may be locally displaced from winter range due to development in sagebrush-grassland areas. Increased human presence and improved road access within the BNGPA could result in increased poaching impacts on big game populations. These potential impacts would remain for the life of the project. Indirect impacts on big game would include reduced use of habitats that are near or adjacent to project facilities and displacement of animals out of portions of designated ranges and into less suitable habitats. Operation and maintenance of the facilities would result in increased human activities and noise levels in and around the development sites. These activities could negatively impact big game through displacement or behavioral avoidance.

Pronghorn, mule deer, and white-tailed deer would be impacted by this project from habitat disturbance and fragmentation, and mortalities from collisions with vehicles. These species probably would reduce their use of disturbed areas in the short term; however, these species probably will become more habituated to the activity and return to disturbance areas as the project moves into the production phase and the level of human activity is reduced. Because elk, moose, and bison occur in the BNGPA at very low numbers if at all, disturbance to these species and their habitats would be minimal, and would not affect the long term viability of these species. Impacts to big game species would be minimized by implementing the following BLM mitigation measures:

- Provide all drivers with a training session describing the types of wildlife species in the area that are susceptible to vehicular collisions to reduce the potential for vehicle/big game collisions. The circumstances under which such collisions are likely to occur, and the measures that could be employed to minimize them should be discussed. Reduced speed limits would be implemented to reduce potential for vehicle/wildlife collisions.
- No surface disturbance in big game winter range from December 1 – May 15.

Upland Game Birds: Upland game birds, greater sage-grouse and sharp-tailed grouse in particular, would be impacted under Alternative A from habitat disturbance and fragmentation. Roads, vehicles, structures, noise levels, and human activity during the breeding season, would hinder, and may reduce breeding activity, displace some grouse nesting activity, and reduce habitat availability for brood rearing. Mortality would increase as a result of collisions with vehicles. Sharp-tailed grouse can be found throughout the BNGPA, and would be more affected than greater sage-grouse. Much of the suitable sage-grouse nesting habitat is in the southern half of the BNGPA. Development within suitable nesting habitat two miles from leks may reduce the quantity and quality of grouse nesting sites potentially leading to higher rates of nest abandonment or failure. Compressor facilities for this project have been authorized by the MDEQ. Actual measured decibel levels from similar compressor facilities in the natural gas development south of the BNGPA are within the decibel limits established to effectively reduce impacts of noise to susceptible wildlife species (most notably greater sage-grouse and sharp-tailed grouse). Deploying PC pumps where feasible and maximizing the use of electric power to operate artificial lifts could reduce potential impacts caused by these devices. Installing hospital-grade mufflers at compressor and pump jack sites and directing exhaust pipes away from lek sites could reduce decibel levels further and mitigate potential impacts. Installation of aerial power lines could pose a collision hazard to upland game birds. In addition, the number of upland game bird mortalities would increase because perch opportunities provided by aerial power infrastructure would increase and potentially draw additional raptors into the BNGPA.

Installation of perch deterrents on power line poles would reduce the availability of raptor perch sites thereby reducing upland game bird predation opportunities.

Ring-necked pheasants and gray partridges are highly adaptable species that are fairly tolerable to moderate human disturbance, and wild turkey range within the BNGPA is limited to riparian areas that are not expected to be heavily impacted. Impacts to these species would be minimal, and would not affect their long-term viability within the BNGPA. Impacts to upland game birds would be minimized by implementing the following BLM mitigation measures:

- Develop nest-avoidance, timing restrictions, and/or additional mitigation measures for nests located on or adjacent to project developments.
- Avoiding important sharp-tailed grouse nesting habitat during the breeding season from March 15 – June 15.
- No surface disturbance within ¼ mile of sharp-tailed grouse leks from March 15 – June 15.
- Avoiding important greater sage-grouse nesting habitat during the breeding season from March 1 – June 30
- No surface disturbance within ¼ mile of greater sage-grouse leks from March 1 – June 30.
- Require a one-day notice prior to any planned activity during March 1 – June 30 so that the pad site and any undeveloped access route or pipeline can be nest-dragged to determine the presence or absence of active nests.
- Require a second nest-drag survey if drilling activity begins more than two days after completion of pad construction.
- Prioritizing pad development based on suitability of habitat; construct pads that are in less suitable habitat (i.e., along existing roadways or within degraded habitats) during the breeding season, and construct pads located in more suitable habitat prior to or after the critical breeding season.
- Limit vehicular traffic and human visitation to well sites and facilities within ¼ mile of lek sites until after 9:00 a.m. daily during the production phase.
- Avoid sagebrush, but if disturbance is necessary, interim reclamation should include sage plantings/seedings and/or the use of minimum disturbance practices to protect sage on well pads and pipelines

Raptors: Implementation of Alternative A would result in the direct loss of habitat and cause habitat fragmentation. The potential impacts to raptors include nest abandonment and/or reproductive failure due to project activities or increased public access, reduction in prey populations, mortality from vehicle collisions, and loss of nesting and /or foraging habitat. Some raptors feed on carrion on and along the roads, while others (owls) may attempt to capture small rodents and insects that are illuminated in headlights. These raptor behaviors put them in the path of oncoming vehicles where they are in danger of being struck and killed. The potential for such collisions could be reduced by requiring that drivers undergo training that describes the circumstances under which vehicular collisions are likely to occur and possible measures to minimize them. In addition, project development would disturb habitat for raptor prey species. The amount of short-term change in prey base populations created by construction is expected to be minimal in comparison to the overall level of small mammal populations. While prey populations in the BNGPA would likely sustain some reduction during the development phase of the project, most prey species would be expected to rebound to pre-disturbance levels following initial reclamation. Once reclaimed, these areas would likely promote an increased density and biomass of small mammals that is comparable to those of undisturbed areas (Hingtgen and

Clark 1984). For these reasons, no measurable long-term reductions to the prey base would be anticipated. However, prey populations could be displaced due to habitat loss.

Installation of aerial power lines could pose a threat to raptor species. To reduce the risk of electrocution, the most current raptor protection guidelines would be followed. In general, conductor separation methods are preferable to perching deterrents. However, raptor mortalities do occur even with properly installed raptor protection devices on new or retrofitted poles, and could occur under this alternative. Even following the strictest of construction guidelines and providing state-of-the-art mitigation, aerial power lines provide an element of risk to raptors. Aerial power lines also pose a collision hazard to all avian species, especially raptors and upland game birds. The number of mortalities of raptor prey species would increase because perch opportunities provided by aerial power infrastructure would increase and potentially draw additional raptors into the BNGPA. However, the increased human presence and habitat fragmentation within the BNGPA may counter-balance these effects and discourage raptors from using some disturbed areas. Impacts to raptors due to aerial power lines would be reduced by implementing practical alternatives such as burying power lines and/or utilizing solar energy at well houses. In addition, impacts to raptor species would be minimized by implementing the following BLM mitigation measures:

- Provide all drivers with a training session describing the types of wildlife species in the area that are susceptible to vehicular collisions to reduce the potential for vehicle/raptor collisions. The circumstances under which such collisions are likely to occur, and the measures that could be employed to minimize them should be discussed. Reduced speed limits would be implemented to reduce potential for vehicle/wildlife collisions.
- Coordinate with MFWP to formulate and implement a removal program for wildlife carcasses along roadways to avoid further mortality of raptors attracted to carcasses.
- No surface disturbance within ½ mile of bald eagle winter roost sites from November 30–March 31.
- Limit vehicular traffic and human visitation to well sites and facilities within ½ mile of bald eagle winter roost sites until after 9:00 a.m. daily during the production phase.
- Install and maintain power line facilities to reduce raptor collisions and electrocutions, and discourage perching and nest-building on infrastructure.
- Conduct nesting raptor surveys in suitable nesting habitats within ½ mile of proposed disturbance. Surveys could be conducted throughout the year; however, any potential nest sites located must be resurveyed during the breeding season to determine activity. Construction activities would be prohibited within ½ mile of active nests from March 1–August 1, or until fledging and dispersal of the young.

Colonial Nesting Waterbirds: Impacts to colonial nesting waterbirds could include habitat loss and alteration, anthropogenic disturbance, displacement, and colony abandonment. Research indicates that colonial nesting species are negatively impacted by habitat alteration. Because colonial nesting waterbirds build large aggregations of nests in relatively small areas, the effects of local disturbances can have major consequences including multiple nest failures or ultimately, colony abandonment. Active colonies of great blue herons, white pelicans, and other colonial nesting species should be protected from surface access particularly during the breeding season to avoid impacts. Various colonial nesting species form colony assemblages; therefore, avoidance of known colony sites would minimize impacts to numerous species. Minimizing disturbance to wetland areas, especially prairie potholes, would minimize impacts to smaller

single-species colonies that occasionally form during wetter years. Impacts to colonial nesting waterbirds would be minimized by implementing the following BLM mitigation measures:

- No surface disturbance within colonies from March 15–July 15.
- Minimize or avoid disturbance near important nesting and foraging areas such as Nelson Reservoir, Whitewater Lake, Pea Lake, Hewitt Lake, and other areas identified by the BLM based on the most current information available.

Shorebirds and Other Waterbirds: Impacts to shorebirds and other waterbirds could include habitat loss and alteration, disturbance, displacement, and mortality. Construction of well pads and temporary retention and produced water pits used at drill sites may pose a risk to shorebirds and waterfowl. Avoidance of wetlands or minimizing disturbance near wetlands habitats, including prairie potholes, alkali lakes, and playas, would reduce impacts to shorebirds and waterfowl. Impacts to shorebirds and other waterbirds would be minimized by implementing the following BLM mitigation measures:

- Minimize or avoid disturbance near important nesting and foraging areas at Nelson Reservoir, Whitewater Lake, Pea Lake, and Hewitt
- Require a one-day notice prior to any planned activity during April 15 – July 15 so that the pad site and any undeveloped access route or pipeline can be nest-dragged to determine the presence or absence of active nests.
- Require a second nest-drag survey if drilling activity begins more than two days after completion of pad construction.
- Prioritize pad development based on suitability of habitat; construct pads that are in less-suitable habitat (i.e., along existing roadways or within degraded habitats) during the breeding season, and construct pads located in more suitable habitat prior to or after the critical breeding season.

Migratory Birds: Impacts to migratory birds would include habitat loss and alteration, disturbance, displacement, and mortality. Migratory birds could be displaced from areas within or adjacent to the BNGPA. Construction also could disrupt courtship or nesting of birds on or adjacent to those areas. The BNGPA contains portions of the most extensive intact grassland prairie in Montana, which provides critical habitat for many migratory birds (Lenard et al. 2006). Given that abundant habitat exists outside of the BNGPA, birds displaced by construction would relocate to adjacent suitable habitat in the short-term. Long-term impacts are not expected to occur if the reclamation of well pads and pipelines employs the best possible methods. Construction and operation of well pads and compressor sites would remove potential habitat for the estimated life of the project, but would have no measurable influence on the abundance or distribution of migratory birds at the regional scale. Impacts associated with construction of proposed pipelines would be limited to the construction and reclamation phase, and would have no measurable influence on the abundance or distribution of migratory birds at the regional scale. Impacts would be temporary to long-term until successful restoration of pre-disturbance vegetation occurs along pipeline rights-of-way and reclaimed portions of access roads and well pads. With the resultant project infrastructure, habitat fragmentation, and increased human disturbance, some impacts to nesting and migrating Neotropical bird species would be expected. The primary impacts would be disturbance of preferred nesting habitats, improved habitat for undesirable competitors such as brown-headed cowbirds, and increased vehicle collisions. Impacts to migratory birds in currently undisturbed areas would be greatest. In general, habitats in undisturbed areas assume more breeding activity than habitats along

existing roadways and disturbance. Impacts to migratory birds would be minimized by implementing the following BLM mitigation measures:

- Develop nest-avoidance, timing restrictions, and/or additional mitigation measures for nests located on or adjacent to project developments. In cases where development is allowed to continue provide special protection using panels or other markers if known nests are nearby.
- Avoiding important nesting habitat during the breeding season from April 15th – July 15th.
- Minimize disturbance to intact grassland prairie to preserve grassland nesting habitat for endemic and specialist species.
- Minimize disturbance to intact sagebrush steppe to preserve sagebrush nesting habitat for obligate and specialist species.
- Require a one-day notice prior to any planned activity during April 15th – July 15th so that the pad site and any undeveloped access route or pipeline can be nest-dragged to determine the presence or absence of active nests.
- Require a second nest-drag survey if drilling begins more than two days after completion of pad construction. No surface disturbance at active nest sites between April 15th – July 15th (Migratory Bird Treaty Act; E.O. 13186).
- Prioritizing pad development based on suitability of habitat; construct pads that are in less suitable habitat (e.g., along existing roadways or within degraded habitats) during the breeding season, and construct pads located in more suitable habitat prior to or after the critical breeding season.
- Eliminating migratory bird access to reserve pits that store or are expected to store fluids that pose a risk to these birds (e.g., waterfowl, shorebirds, raptors, and songbirds) during drilling and completion activities and until such pits are reclaimed. Exclusion methods could include netting, the use of “bird-balls” or other alternative methods that effectively eliminate migratory bird access to pit contents and meet with BLM approval. It would be the responsibility of the operator to notify the BLM of the proposed method two weeks before drilling activities are expected to begin. The BLM-approved method would be applied within 24 hours after drilling activities have begun. All lethal events and other significant information, such as discovery of a nesting attempt, involving migratory birds would be immediately reported to the appropriate personnel at the Malta Field Office.

Amphibians and Reptiles: Impacts to amphibians and reptiles could include habitat loss and alteration, fragmentation, and mortality. Impacts to wetlands would affect amphibian foraging, breeding, and wintering habitat. Amphibian species do not appear to be using production ponds at well sites, so an increase in these features probably will have no effect. Increased vehicle traffic and human presence would result in higher road mortalities to many species of herpetafauna and potentially more human persecution, including harassment and killing, of certain snake species, particularly rattlesnakes. Impacts to amphibians and reptiles would be minimized by implementing the following BLM mitigation measures:

- Develop breeding-site avoidance, timing restrictions, and/or additional mitigation measures for breeding areas located on or adjacent to project developments.
- Minimize or avoid disturbance in or near wetland areas.

Fish: Potential impacts to aquatic species and aquatic habitat include: increases in suspended sediments and sedimentation from erosion caused by road, pipeline, produced water evaporation pit and well pad construction. Produced waters will be placed in the evaporation pits and will not be discharged to surface waters; therefore, they should not affect fish or other aquatic life. Effects from changes in water quality should be limited to small increases in sedimentation, which would be minor and not detrimental to populations of any aquatic species. Effects on aquatic species from increased erosion should be minor due to no on-drainage impoundments (reservoirs), design criteria for road, pipeline and evaporation pit construction, and mitigation measures that are designed to reduce erosion and sedimentation in water bodies including the following:

- Install temporary equipment bridges across flowing waterbodies.
- Place topsoil and spoil at least 10 feet away from the water's edge.
- Bury pipelines at least 5 feet below the bottom of each drainage.
- Cross streams during periods of low flow and complete the crossing within 24 hours, as feasible.
- Install erosion and sediment control measures, as discussed in the Soils section to prevent the flow of spoil into any waterbodies.
- Maintain erosion and sediment control measures until streambanks and adjacent upland areas are stabilized.
- Reestablish pre-construction bed and bank contours, revegetate streambanks, and install erosion control fabric to stabilize the streambanks.
- Limit construction equipment working in wetlands to that essential for clearing, trench excavation, pipe fabrication and installation, backfilling, and restoration.
- Cut shrubs flush with the surface of the ground.
- Limit stump removal, grading, topsoil segregation, and excavation in wetlands to the area immediately over the trenchline to avoid excessive disruption of soils and the native seed and rootstock within the soils.
- Prohibit storage of hazardous materials, chemicals, fuels, lubricating oils, and concrete coating and refueling activities within 200 feet of any waterbody or wetland.
- Minimize erosion from upland areas by restoring and seeding the project area as discussed in the Vegetation and Soils sections, and in **Appendix D—Reclamation Plan**.
- Withdraw and discharge hydrostatic test water in accordance with all applicable permits.
- Test water quality during withdrawal and discharge in accordance with permit stipulations and conditions. Discharges to any water body must meet all applicable permit limits and not cause exceedances of water quality standards.
- Utilize screens on the intake hoses at surface water sources to prevent the entrapment of fish or other aquatic species and monitor the appropriation rate to ensure that adequate downstream flow is maintained to support aquatic life.

- Install energy-dissipating devices and/or filter bags to prevent scour, erosion, suspension of sediment, and damage to vegetation. Monitor discharge rates to ensure effectiveness of the energy-dissipating device.

Cumulative Impacts

Development under Alternative A would have temporary to long-term impacts on wildlife resources. Construction of roads, production well pads and compressor sites would result in the long-term loss of habitat and forage on approximately 0.0008 percent of the BNGPA under Alternative A. Vegetation removal would result in a loss of cover, nesting, and forage habitat. The degree of impact would depend on the type of habitat affected and the regeneration rate of vegetation after construction. Impacts would be limited to the construction and reclamation phase of the each project, and would be greatest where other projects are constructed within the same period and area as the Alternative A. Additional mortalities to wildlife would occur from collisions with vehicles and power lines because of additional roads and increased vehicle traffic, and additional aerial power lines. Indirect impacts would occur from habitat disturbance, human presence and possible diminished water quality. Areas around well pads, compressor sites, and along access roads would be indirectly affected because human activities would disturb or inhibit wildlife in these areas, and render them less suitable, especially in sections with 80-acre well spacing. The higher density of well pads, access routes, and gas gathering infrastructure, and increase in human visitation and vehicular traffic in these areas may lead to greater displacement of wildlife species into adjacent habitat. However, due to abundant suitable habitat throughout the BNGPA, at the scale proposed, the project would have no measurable influence on the abundance or distribution of wildlife.

As new development occurs, direct and indirect impacts would continue to stress wildlife populations, most likely displacing larger, mobile species into adjacent habitat, and increasing competition with existing local populations. Non-mobile animals would be affected by increased habitat fragmentation, interruptions to preferred nesting habitats, and increased potential for predation. Many species are localized to the area in and around the BNGPA and rely on key habitat areas during certain times of the year. These species include big game, raptors, colonial nesting waterbirds, shorebirds, waterfowl, and amphibians. Cumulative impacts would be minimized by co-locating reasonably foreseeable future projects in existing utility corridors to the extent feasible, implementing measures that prohibit construction activities during sensitive wildlife periods, and controlling non-native, noxious weed species through management and reclamation.

4.12.2 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts

Impacts to aquatic and wildlife resources from the Proposed Action are essentially the same as those described in Alternative A; however, the scope of the impacts are more widespread because of the increased development associated with Alternative B, and the expansion of activities to undeveloped federal lands. Development under the Proposed Action would result in the direct loss of 2,646 acres of habitat initially, and the direct loss of 1,249 acres of habitat for the estimated life of the project. The number of acres disturbed and the number of miles of roads and utility corridors under Alternative B would be more than Alternative A, but less than Alternative C. In addition, well pad and linear feature (i.e., roads, pipelines, other utilities, etc.) densities under Alternative B would be higher than under Alternative A, but lower than Alternative C. Due to limited information, it is difficult to quantify the population-level effects of energy development and the thresholds that trigger negative effects on specific species. Current

ecological research is seeking to better understand the impacts energy development may be having on wildlife populations, and is attempting to identify the specific mechanisms causing impacts. Nevertheless, it is reasonable to consider that increases in energy development infrastructure and density could potentially cause an increase in negative population effects to certain species, depending upon the scale at which the species respond. Negative effects may not be directly proportional to the increase in disturbance. Until research examines the spatial and temporal trends in specific species populations and determines the level at which energy development and habitat quantity and quality affect population metrics, any conclusions will be anecdotal or speculative. Overall, the direct and indirect impacts are greater under the Proposed Action in comparison with Alternative A, but less than impacts under Alternative C.

Big Game Species: The types of impacts to big game species and their habitats would be the same as identified under Alternative A. However, additional development would include federal lands, and the level of impacts would be greater and more widespread. The application of the Timing Condition of Approval would prevent disturbances such as well drilling, pipeline construction, and road building during the most crucial time of the year for big game species.

Upland Game Birds: The types of impacts to upland game birds and their habitats would be the same as identified under Alternative A. However, additional development would include federal lands, and the level of impacts would be greater and more widespread. Roads, vehicles, structures and human activity may displace some grouse nesting activity and reduce habitat availability for brood rearing. Mortality would increase as a result of collisions with vehicles. However, the application of the Timing Condition of Approval would minimize disturbance during the critical breeding, nesting, and brood-rearing period.

Raptors: The types of impacts to raptors and their habitats would be the same as identified under Alternative A. However, additional development would include federal lands, and the level of impacts would be greater and more widespread. As with grouse, roads, vehicles, structures and human activity may displace raptors into adjacent nesting habitat, or increase mortality from vehicle collisions. The application of the Timing Condition of Approval for active raptor nests would prevent surface-disturbing activities and associated disturbances around active raptor nests during the nesting period.

Colonial Nesting Waterbirds: The types of impacts to colonial nesting waterbirds and their habitats would be the same as identified under Alternative A. However, additional development would include federal lands, and the level of impacts would be greater and more widespread. The application of the Timing Condition of Approval for various other species would help to protect colonial nesting waterbirds that occupy the same areas.

Shorebirds and Other Waterbirds: The types of impacts to shorebirds and other waterbirds and their habitats would be the same as identified under Alternative A. However, additional development would include federal lands, and the level of impacts would be greater and more widespread. The application of the Timing Condition of Approval for various other species would help to protect shorebirds and other waterbirds that occupy the same areas.

Migratory Birds: The types of impacts to migratory birds and their habitats would be the same as identified under Alternative A. However, additional development would include federal lands, and the level of impacts would be greater and more widespread. The application of the Timing Condition of Approval for various other species would help to protect migratory birds that occupy the same areas.

Amphibians and Reptiles: The types of impacts to amphibians and reptiles and their habitats would be the same as identified under Alternative A. However, additional development would include federal lands, and the level of impacts would be greater and more widespread. The application of the Timing Condition of Approval for various other species would help to protect amphibians and reptiles that occupy the same areas.

Fish: Potential effects to fish and other aquatic life from Alternative B would be expected to increase in direct proportion to the greater number of wells that will be drilled compared to Alternative A. These effects, however, should still be relatively minor, for the same reasons discussed in Alternative A.

Cumulative Impacts

The types of impacts to wildlife resources would be the same as identified under Alternative A. However, additional development would include federal lands, and the level of impacts would be greater and more widespread. Construction of roads, production well pads, and compressor sites would result in the long-term loss of habitat and forage on approximately 0.0015 percent of the BNGPA under the Proposed Action. Because effects of this project should be minor, they should not contribute to the cumulative effects of other area projects on wildlife and fish.

4.12.3 Alternative C— Maximum Development Alternative

Direct and Indirect Impacts

Impacts to aquatic and wildlife resources from development under Alternative C are essentially the same as those described in Alternatives A and B. However, the scope of the impacts is more widespread because of the increased development associated with Alternative C. Development under Alternative C would result in the direct loss of 3,998 acres of habitat initially, and the direct loss of 1,890 acres of habitat for the estimated life of the project. The number of acres disturbed and the number of miles of roads and utility corridors under Alternative C would be more than under Alternatives A or B. In addition, well pad and linear feature (i.e., roads, pipelines, other utilities, etc.) densities under Alternative C would be higher than under Alternatives A or B. Although information is limited, development under Alternative C may surpass disturbance or density-dependent thresholds, which may negatively affect local populations of certain species. The direct and indirect impacts are greatest under Alternative C in comparison with those under Alternatives A or B.

Big Game Species: The types of impacts to big game species and their habitats would be the same as identified under Alternatives A and B. However, because of the additional development under Alternative C, the level of impacts would be greater than under Alternatives A or B.

Upland Game Birds: The types of impacts to upland game bird species and their habitats would be the same as identified under Alternatives A and B. However, because of the additional development under Alternative C, the level of impacts would be greater than under Alternatives A or B.

Raptors: The types of impacts to raptor species and their habitats would be the same as identified under Alternatives A and B. However, because of the additional development under Alternative C, the level of impacts would be greater than under Alternatives A or B.

Colonial Nesting Waterbirds: The types of impacts to colonial nesting waterbird species and their habitats would be the same as identified under Alternatives A and B. However, because of

the additional development under Alternative C, the level of impacts would be greater than under Alternatives A or B.

Shorebirds and Other Waterbirds: The types of impacts to shorebird and other waterbird species and their habitats would be the same as identified under Alternatives A and B. However, because of the additional development under Alternative C, the level of impacts would be greater than Alternatives A or B.

Migratory Birds: The types of impacts to migratory bird species and their habitats would be the same as identified under Alternatives A and B. However, because of the additional development under Alternative C, the level of impacts would be greater than under Alternatives A or B.

Amphibians and Reptiles: The types of impacts to amphibian and reptile species and their habitats would be the same as identified under Alternatives A and B. However, because of the additional development under Alternative C, the level of impacts would be greater than under Alternatives A or B.

Fish: Potential effects to fish and other aquatic life from Alternative C would be expected to increase in direct proportion to the greater number of wells that will be drilled compared to Alternative A. These effects, however, should still be relatively minor, for the same reasons discussed in Alternative A.

Cumulative Impacts

The types of impacts to wildlife resources would be the same as identified under Alternatives A and B. However, because of the additional development under Alternative C, the level of impacts would be greater than under Alternatives A and B. Construction of roads, production well pads, and compressor sites would result in the long-term loss of habitat and forage on approximately 0.002 percent of the BNGPA under Alternative C. Despite the greater disturbance and density due to energy development under Alternative C, effects of this project should remain relatively minor, and should not contribute to the cumulative effects of other area projects on wildlife and fish.

4.13 SPECIAL STATUS WILDLIFE, FISH, AND PLANT SPECIES

4.13.1 Alternative A—No Federal Action

Direct and Indirect Impacts

Threatened, Endangered, Candidate or Proposed Species of Wildlife, Fish, and Plants. Development activities under Alternative A may affect some threatened, endangered, candidate or proposed species of wildlife, fish, and plants through habitat loss, alteration, and fragmentation, disturbance, displacement, and mortality. However, significant impacts to these species due to development under Alternative A are not expected. Black-footed ferrets do not occur within the BNGPA. In addition, prairie dogs, their primary prey, do not occur in large enough numbers or densities to support black-footed ferrets. Consequently, black-footed ferrets would not be impacted by Alternative A. Interior least terns have been observed foraging within the BNGPA. Although suitable nesting habitat occurs within the BNGPA, no breeding colonies have been documented. Development of the project may remove some foraging habitat, but is not expected to have any direct impact on breeding.

Piping plovers breed and forage within the BNGPA. Piping plovers may be affected by habitat loss and alteration, and human disturbance. Development of the project may remove nesting and foraging habitat. Well pad development on islands in Nelson Reservoir may have considerable impacts to piping plover nesting areas. Nelson Reservoir is known to have islands that support nesting piping plovers. In addition, some islands are located near beaches used by piping plovers for nesting. Development may cause piping plovers to abandon or avoid these preferred nesting sites. Displacement to other areas may not be possible as alternate suitable nesting areas are limited. Notwithstanding, recent cooperative island enhancement and habitat improvement projects at Whitewater Lake may compensate for some losses due to any planned development, and if successful, could prove to be useful for any future off-site mitigation projects.

Whooping cranes rarely are observed within the BNGPA. Development of the project may remove some foraging habitat, but significant adverse effects are unexpected. There would be "no effect" to the endangered pallid sturgeon. This is due to: (1) No habitat present in the project area. The closest that pallid sturgeon may occur to the project area is in the Milk River near its confluence with the Missouri River, approximately 140 river miles downstream. (2) The project is anticipated to have only minor impacts on water quality and aquatic habitat, primarily small increases in suspended sediment and sedimentation, in the project area. These impacts would not affect water quality or habitat for pallid sturgeon in the lower Milk River or in the Missouri River downstream of the Milk River.

BLM Sensitive species and Montana Animal and Plant Species of Concern. Impacts to BLM sensitive species and Montana species of concern would be associated with habitat loss, alteration, and fragmentation, disturbance, displacement, and mortality related to natural gas infrastructure construction and maintenance, increased human activity, and habitat conversion from native communities to non-native and early-seral communities. Current data suggests that nearly 20 percent of the sensitive species that have the potential to occur in the BNGPA either are present in very low numbers as transients or have not been documented in recent surveys.

Mammal Species. Impacts to BLM sensitive mammal species could include habitat loss, alteration, and fragmentation, disturbance, displacement, and mortality. Black-tailed prairie dogs and swift foxes occur within the BNGPA and may be impacted by development under Alternative A. Portions of three black-tailed prairie dog colonies, accounting for approximately 18 percent (129 acres) of the total acreage of colonies, occur on private lands within the BNGPA. Swift foxes are increasingly common in the northern portion of the BNGPA. Development in these areas has the potential to impact these species, primarily through habitat loss and alteration from construction activities, mortalities from collisions with vehicles and human harassment or killing. Although Preble's shrews and Townsend's big-eared bats have the potential to occur in suitable habitat, neither species has been documented within the BNGPA. It is unlikely that either of these species will be impacted by Alternative A.

Bird Species. Impacts to sensitive bird species could include habitat loss, alteration, and fragmentation, disturbance, displacement, and mortality. Impacts to colonial nesting species such as American white pelicans, black terns, black-crowned night-herons, Caspian terns, common terns, Forster's terns, Franklin's gulls, and white-faced ibis would be essentially the same as those described above under Colonial Nesting Waterbirds. Caspian and common terns are the only two species that currently have colonies within the BNGPA that might be affected by development under Alternative A. The remaining colonial nesting species regularly occur within the BNGPA, and may be impacted by a loss of foraging habitat. Impacts to various species closely associated with wetlands such as alder flycatchers, common loons, LeConte's

sparrows, sedge wrens, and yellow rails are not anticipated because wetland habitat loss is not expected. Impacts to common loons and LeConte's sparrows from disturbance associated with activities under Alternative A may occur but is expected to be minimal. Alder flycatchers, sedge wrens, and yellow rails are rarely observed and have not been documented within the BNGPA. Therefore, it is unlikely that these species will be impacted by Alternative A.

Impacts to burrowing owls and mountain plovers, species that are closely associated with prairie dog colonies, would be similar to those described in the previous section, Mammal Species. The majority of burrowing owl nest sites within the BNGPA are located within the existing prairie dog colonies around Hewitt Lake and Nelson Reservoir. Loss of burrowing owl nesting and foraging habitat may result from construction activities under Alternative A. Mountain plovers rarely are observed foraging within the BNGPA, and nesting has not been documented. Under Alternative A, no significant impacts to mountain plovers are expected due to the species' infrequent use of habitats within BNGPA and the availability of abundant suitable habitat south of the project area.

Impacts to grassland specialists and prairie endemics such as Baird's sparrows, bobolinks, chestnut-collared longspurs, grasshopper sparrows, lark buntings, long-billed curlews, McCown's longspurs, and Sprague's pipits would include habitat loss, alteration, fragmentation, disturbance, and displacement. These species are common to very abundant within the BNGPA. Loss, alteration, and fragmentation of the preferred habitat of these species and local displacement is expected under Alternative A; however, these impacts are expected to be minimal to displaced individuals due to the availability of abundant suitable habitat surrounding the BNGPA. Impacts to sagebrush obligates and specialists such as Brewer's sparrows, greater sage-grouse, loggerhead shrikes, and sage thrashers would include habitat loss, alteration, and fragmentation, disturbance, displacement, and mortality. Impacts due to habitat loss, alteration, and fragmentation would be long term as the preferred habitat of these species requires decades to return to pre-disturbance conditions. However, silver sage is the predominant sagebrush species within the BNGPA and re-establishment of this species after disturbance occurs more rapidly than big sagebrush species. Therefore, impacts due to disturbance in silver sagebrush habitats would be shorter in duration as this species requires less time to return to pre-disturbance conditions. Increased human activity and use of the BNGPA would increase the potential for sage-grouse mortalities due to collisions with vehicles. Seven greater sage-grouse leks are located within the BNGPA, the most significant of which are located in the Saco Hills in the south. Development in this area will have greater effects on greater sage-grouse than development in the northern portion of the BNGPA. Loss of nesting and brood-rearing habitat from construction activities under Alternative A might further diminish this limiting resource.

Impacts to sensitive raptor species could include habitat loss, alteration, fragmentation, disturbance, displacement, and mortality. Bald eagles do not breed within the BNGPA, but do occur in the area during migration and winter. Bald eagles may be affected by the project in several ways including human disturbance, equipment noise, electrocution, collisions with power lines, and collisions with vehicles. Wintering bald eagles are sensitive to disturbance at roost sites and during foraging activities. Development of the project may remove some bald eagle foraging habitat. However, the project may also result in more carrion being available to bald eagles because of big game and small mammal road mortalities. An increase in carrion near roads may pose a risk to bald eagles because they may be struck and killed by vehicles.

Impacts to ferruginous hawks and Swainson's hawks could include loss of nesting habitat and disturbance. Impacts to migrant or wintering raptors such as northern goshawks and peregrine falcons would include loss of foraging habitat, but would be minimal due to the relatively rare use of the BNGPA by these species. Impacts to various transient species such as black-and-

white warblers, gray-crowned rosy-finches, harlequin ducks, Nelson's sharp-tailed sparrows, northern hawk owls, olive-sided flycatchers, red-headed woodpeckers, and yellow-billed cuckoo could include loss of foraging habitat and cover, but would be minimal. The BNGPA is outside the primary distribution of the majority of these species and their occurrence in the area is rare and unpredictable.

Amphibian and Reptile Species. Impacts to sensitive amphibian and reptile species could include habitat loss, alteration, and fragmentation, and mortality, and would be similar to those described under Amphibians and Reptiles. Only northern leopard frogs, greater short-horned lizards, and western hog-nosed snakes have been documented within the BNGPA. Great plains toads, Plains spadefoots, and sagebrush lizards have the potential to occur within the BNGPA, but due to their rarity and low numbers are not expected to be impacted by Alternative A. Disturbance to wetland habitats under Alternative A is expected to be negligible; therefore, impacts to amphibian species are not expected. Although some suitable sagebrush lizard habitat exists within the BNGPA, the presence of this species is very unlikely because the project area is at the limit of its distribution.

Fish Species. Because the project is only anticipated to have minor effects on water quality and aquatic habitat in the project area, primarily small increases in sedimentation, the project should not have significant effects on BLM sensitive fish species and Montana fish species of concern. Paddlefish, pallid sturgeon and shortnose gar do not occur in the project area and only occur relatively far downstream in the Milk River near the confluence with the Missouri River or in the Missouri River. Pearl dace and sauger may occur in the Milk River within the project area.

Plant Species. No impacts to Montana plant species of concern are expected within the BNGPA from development activities under Alternative A. Chaffweed, dwarf woolly-heads long-sheathed waterweed, roundleaf water-hyssop, scarlet ammannia, slender-branched popcorn flower, and slender bulrush are associated with aquatic or wetland habitats. Development under Alternative A is not expected to impact any wetlands; therefore, no impacts are expected to occur to these species. Hot spring phacelia has not been documented in the BNGPA since 1982, and is not expected to be impacted due to its habitat (i.e., adjacent to steep slopes) and possible extirpation.

Cumulative Impacts

Development under Alternative A would have temporary to long-term impacts on special status wildlife, fish, and plant species. Vegetation removal would result in a loss of cover, nesting, and forage habitat. The degree of impact would depend on the type of habitat affected and the regeneration rate of vegetation after construction. Impacts would be limited to the construction and reclamation phase of each project, and would be greatest where other projects are constructed within the same period and area as for Alternative A. Additional mortalities to wildlife would occur from collisions with vehicles and power lines because of additional roads, increased vehicle traffic, and additional aerial power lines. Indirect impacts would occur from habitat disturbance, human presence and possible diminished water quality. Areas around well pads, compressor sites, and along access roads would be indirectly affected because human activities would disturb or inhibit sensitive species in these areas and render them less suitable. However, due to abundant suitable habitat throughout the BNGPA, the project would have no measurable influence on the abundance or distribution of sensitive species at the scale proposed. As new development occurs, direct and indirect impacts would continue to stress wildlife populations, most likely displacing larger, mobile species into adjacent habitat, and increasing competition with existing local populations. Non-mobile animals would be affected by increased habitat fragmentation, interruptions to preferred nesting or denning habitats, and

increased potential for predation. Cumulative impacts would be minimized by co-locating reasonably foreseeable future projects in existing utility corridors to the extent feasible, implementing measures that prohibit construction activities during sensitive wildlife periods, and controlling non-native, noxious weed species through management and reclamation. Because effects of this project should be minor, they should not contribute to the cumulative effects of other area projects on fisheries/aquatics.

4.13.2 Alternative B—Proposed Action, with Additional Mitigation

Direct and Indirect Impacts

Threatened, Endangered, Candidate or Proposed Species of Wildlife, Fish, and Plants. Impacts to threatened, endangered, candidate or proposed species of wildlife, fish, and plants from the Proposed Action are essentially the same as those described in Alternative A; however, the scope of the impacts are more widespread because of the increased development associated with Alternative B and the expansion of activities to undeveloped federal lands.

The types of impacts to threatened, endangered, candidate, or proposed species of wildlife, fish, and plants would be the same as identified under Alternative A.

BLM Sensitive species and Montana Animal and Plant Species of Concern. Impacts to BLM sensitive species and Montana species of concern from the Proposed Action are essentially the same as those described in Alternative A; however, the scope of the impacts are more widespread because of the increased development associated with Alternative B, and the expansion of activities to undeveloped federal lands.

Mammal Species. The types of impacts to sensitive mammal species and their habitats would be the same as identified under Alternative A. However, additional development would include federal lands and the level of impacts would be greater and more widespread.

Bird Species. The types of impacts to sensitive bird species and their habitats would be the same as identified under Alternative A. However, additional development would include federal lands and the level of impacts would be greater and more widespread.

Amphibian and Reptile Species. The types of impacts to sensitive amphibian and reptile species and their habitats would be the same as identified under Alternative A. However, additional development would include federal lands and the level of impacts would be greater and more widespread.

Fish Species. The types of impacts to BLM sensitive fish species and Montana fish species of concern would be the same as identified under Alternative A.

Plant Species. The types of impacts to sensitive plant species and their habitats would be the same as identified under Alternative A. However, additional development would include federal lands and the level of impacts would be greater and more widespread.

Cumulative Impacts

The cumulative impacts to special status wildlife, fish, and plant species would be the same as identified under Alternative A. However, additional development under the Proposed Action would include federal lands and the level of impacts would be greater and more widespread.

4.13.3 Alternative C—Maximum Development Alternative

Direct and Indirect Impacts

Threatened, Endangered, Candidate or Proposed Species of Wildlife, Fish, and Plants. Impacts to threatened, endangered, candidate or proposed species of wildlife, fish, and plants from Alternative C are essentially the same as those described in Alternatives A and B; however, the scope of the impacts are more widespread because of the increased development associated with Alternative C.

The types of impacts to threatened, endangered, candidate, or proposed species of wildlife, fish, and plants would be the same as identified under Alternative A.

BLM Sensitive species and Montana Animal and Plant Species of Concern. Impacts to BLM sensitive species and Montana species of concern from Alternative C are essentially the same as those described in Alternatives A and B; however, the scope of the impacts are more widespread because of the increased development associated with development under Alternative C.

Mammal Species. The types of impacts to sensitive mammal species and their habitats would be the same as identified under Alternatives A and B. However, because of the additional development under Alternative C, the level of impacts would be greater than under Alternatives A or B.

Bird Species. The types of impacts to sensitive bird species and their habitats would be the same as identified under Alternatives A and B. However, because of the additional development under Alternative C, the level of impacts would be greater than under Alternatives A or B.

Amphibian and Reptile Species. The types of impacts to sensitive amphibian and reptile species and their habitats would be the same as identified under Alternatives A and B. However, because of the additional development under Alternative C, the level of impacts would be greater than under Alternatives A or B.

Fish Species. The types of impacts to BLM sensitive fish species and Montana fish species of concern would be the same as identified under Alternative A.

Plant Species. The types of impacts to sensitive plant species and their habitats would be the same as identified under Alternatives A and B. However, because of the additional development under Alternative C, the level of impacts would be greater than under Alternatives A or B.

Cumulative Impacts

The cumulative impacts to special status wildlife, fish, and plant species would be the same as identified under Alternatives A and B. However, because of the additional development under Alternative C, the level of impacts would be greater than under Alternatives A and B.

4.14 PUBLIC HEALTH AND SAFETY

4.14.1 Alternative A—No Federal Action

Direct and Indirect Impacts

Under this alternative, there would be no additional development of BLM-managed mineral leases or surface in the BNGPA, but the BLM would continue to approve activities related to the production of federal minerals already developed. Additional development activity would result from the construction of 620 new state and fee wells and associated infrastructure on state and private lands, as well as on BLM-administered lands impacted through the granting of rights-of-way. The existing production operations on state and fee lands in the BNGPA would also continue.

Threats to public and worker safety in the participating area due to field development activity and traffic would be consistent with current levels. It is anticipated that construction and drilling activity would continue for 10 to 15 years, resulting in 40 to 60 wells being drilled per year, with the majority of this activity taking place during the summer and fall. Development-related vehicles using roads within the BNGPA range in size from large sedans and pick-up trucks to drilling and work-over rigs, completion units, construction equipment, and water-hauling trucks. Summer and fall are the seasons of highest recreational use in the area and therefore present the greatest potential for conflict between the public and development activity. The activity resulting from gas production operations would increase over time as more wells are developed. The use of remote well monitoring would likely control production-related vehicle and human traffic at levels consistent with current use. The opportunity for conflict between recreationists, landowners, and gas development-related personnel exists within the field, as does the opportunity for traffic encounters.

Reportable worker safety incidents are not expected to increase as the numbers of participating workers and operating equipment would be consistent with current development levels. Pipeline emergency response plans would be maintained and enhanced as required by DOT regulations, while Worker Right-to-Know and Community Right-to-Know compliance would continue as required. The potential for public exposure to hazardous materials would not change from the current condition.

4.14.2 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts

Under this alternative, there would be additional impacts attributable to the development of BLM-managed mineral leases or surface in the BNGPA. The BLM would approve activities related to federal minerals or federal surface resulting in the development of new federal wells and associated infrastructure on BLM-administered lands. In addition to the additional drilling and production activity, the existing production operations in the BNGPA would continue.

The direct effects of Alternative B include the drilling, completion, and production of an additional 1,255 wells (compared to the current condition) which, combined with the construction and operation of the associated infrastructure, would increase the potential for interaction between the public and anticipated gas development activity. Two to three drilling rigs would be required to develop 100 wells per year assuming the majority of the work takes place during the summer and fall activity season. Some winter drilling is anticipated, weather permitting. This level of development would result in a doubling of the construction, drilling, and completion-related activity and traffic in the field area. This activity would likewise increase the number of wells in production and the amount of water being produced, resulting in an increase in

production-related traffic and water hauling. As described in Alternative A, the opportunity for conflict between recreationists, landowners, and gas development-related personnel exists within the field as does the opportunity for traffic encounters.

Public and worker safety risks would double compared to Alternative A. Emergency planning, employee training and responder notification would continue as discussed in Alternative A. The potential for public exposure to hazardous materials would not change from the current condition.

Mitigation: BNGPA operators propose to implement the BMPs committed to in Alternative B, as well as the following additional measures, in order to minimize impacts due to increased vehicle traffic in the participating area:

- Implementation of a “Good Neighbor” policy
- Remote monitoring of well production where practical and technically feasible
- Traffic safety training
- Signage notifying the public of areas of increased activity
- Consideration of installing centrally located produced-water disposal facilities and a produced-water gathering system

4.14.3 Alternative C—Maximum Development Alternative

Direct and Indirect Impacts

Under this alternative, there would be additional impacts attributable to the drilling, completion, and production of 1,905 additional state, fee, and federal wells in the BNGPA. The BLM would approve activities related to federal minerals or federal surface resulting in the construction of new federal wells or associated infrastructure on BLM-administered lands. In addition to the additional drilling and production activity, the existing production operations in the BNGPA would continue.

The direct effects of implementing the Maximum Development Alternative would include the drilling, completion, and production of 1,905 wells. In addition to the wells, the associated infrastructure would include access roads, flowlines, and power lines. It is anticipated that approximately 150 wells would be drilled per year for 10 to 15 years to achieve maximum development of the BNGPA. Three to four drilling rigs would be required to accomplish this level of development in the summer-through-winter drilling window as well as the associated construction, completion, reclamation, and production activity. The direct effects of implementing Alternative C, the Maximum Development Alternative, would be three to four times that described in Alternative A and double the anticipated activity level seen in Alternative B. Public and worker safety risks would increase by three to four times compared to Alternative A. Emergency planning, employee training and responder notification would continue as discussed in Alternative A. The potential for public exposure to hazardous materials would not change from the current condition.

Indirect effects of implementing Alternative C would include the continuation of the production of existing federal, fee, and state wells in the BNGPA and the continuation of the environmental compliance programs as described in **Ch. 3, Affected Environment** and in **Direct Impacts**, above.

Cumulative Effects

All alternatives analyzed would result in an increase in potential traffic and interpersonal conflict within the operating areas of the BNGPA. Alternative A would result in no additional drilling/development taking place on federally managed lands or minerals. Therefore, additional federal wells would not contribute to the level of increased conflict in the project area. Cumulative effects include the following:

- Greater levels of activity; increased numbers of personnel; an increased number of companies operating in the BNGPA; and increased disturbance of the land, wildlife, and recreational opportunities have the potential to result in increased conflict between the public and project personnel as well as between project personnel.
- Increased industrial activity inherently increases the opportunity for worker injury, but this should not exceed “expected” accident levels for the type of work being undertaken.

4.15 NOISE

4.15.1 Alternative A—No Federal Action

Direct and Indirect Impacts

Direct effects of this alternative include the MBOGC approving the drilling, completion and production of an additional 558 private wells and 62 state wells. In addition to the wells, the associated infrastructure would be constructed including access roads, flowlines, and power lines. Construction and drilling operations would take place at each well site resulting in an increase in noise when compared to the natural background condition of 30 to 50 dBA. Construction, drilling, and completion activities are relatively brief in the BNGPA, lasting from seven to 10 days. Equipment and operational noise would be generated during these activities from a variety of sources including engines, equipment impact, and well flaring. The relatively low horsepower (hp) ratings of the small drilling rigs used in the area aids in keeping the noise generated relatively low. These are short-term events.

Noise is expected from the anticipated installation of artificial lift systems on a large percentage of new and existing wells. Artificial lift is required to continue and enhance the current level of gas production. Natural gas-driven pump jacks will generate noise at the 70 to 80 dBA level at one meter unless hospital-style mufflers are installed. The installation of these mufflers will reduce the noise generated by an individual pump jack to 35-40 dBA at seven to 10 meters. Progressive cavity (PC) pumps are an alternative to pump jack lift systems. These systems are expected to generate 60 to 80 dBA if run off a natural gas-fired generator. If electricity is brought to the site via electrical lines to be used as a power source, no additional noise will be generated. Unless new technology is developed, noises generated by these artificial lift systems are life-of-project impacts.

No increase in project-related noise would take place on BLM-managed minerals and surface relative to the drilling and completion of new wells. Production operations are expected to continue at the current noise levels with the exception of occasional noise related to ongoing production operations, workover operations, and general field maintenance actions. In some situations the noise experienced on federally managed lands and minerals would increase due to the proximity of development and operations on state and fee minerals. In addition, some existing federal wells will realize a natural reduction in gas production that can be reversed by the installation of artificial lift systems which generate noise. Noise levels in the project area

would also continue to be influenced as they are now by weather and occasional vehicle passage.

The WBIP Saco plant and the compressor stations within the gas-gathering and transmission system represent the only continual equipment noise on the landscape that results from the development and production of the natural gas resource. Eighteen compressor stations are in operation in the BNGPA, including the Omimex Whitewater Station located in the middle of the field, and 17 others operated by Bitter Creek Pipeline and scattered throughout the field. One additional compressor station may be constructed in the BNGPA in the Bitter Creek system and two others may be enlarged. All of these facilities are identified on Figure 2.2-1. Noise measurements were obtained at each existing WBIP station in December 2005 and at the Omimex Whitewater Station in March 2007. These measurements are found in Table 14.15-1. The 1,000-foot distance is representative of the noise level that would be encountered at slightly less than ¼ mile from each station. The ¼ mile is significant as this is the distance at which most regulatory agencies require the noise produced by a source to be below 55 dBA.

Table 4.15-1. Noise Readings 1,000 Feet from Compressor Stations in the BNGPA

Compressor Station Name	Compressor Size or Type	dBA @ 1,000 feet			
		East	West	South	North
B	Ajax DPC 115	36.5	45.5	41.0	38.0
South 6”	Ajax DPC 60	36.5	36.1	35.0	41.3
E	Ajax DCP 105	42.1	38.0	40.2	38.7
F	Ajax DPC 80	40.2	37.2	40.2	40.6
G	Ajax DPC 280 LE	39.5	44.0	49.2*	38.7
I/J	Ajax 81	36.8	41.8	30.2	46.1
East Saco	Ajax DPC 180	37.2	46.6	38.3	40.6
West Saco	Ajax DPC 180	41.3	38.0	44.7	49.2
Brookie	Ajax DPC 60	39.4	39.8	38.3	42.5
C/D	Ajax DPC 180 LE	47.3	38.7	42.5	51.1
Hewitt Lake*	Ajax 2802 LE, Ajax 2802 LE	53.0	42.8	54.8	50.0
North Nelson I North Nelson II	Ajax DPC 2802 LE Ajax DPC 2803 LE	58.3	55.2	61.7	51.2
2A	Ajax DPC 180 LE	45.5	70.3	50.8	46.2
JK	Ajax DPC 180 LE Ajax DPC 360	50.0	56.3	55.6	45.5
Whitewater	Engines: 4 – Caterpillar 3516 TA 1 – Waukesha P9390GSI Compressors: 4 – Arial JGH/4 1 – Arial JGK4-3	58.6	62.4	56.9	56.0

** reading may be influenced by winds speed and direction*

Indirect effects of this alternative include the continued production of the existing federal, fee, and state wells in the BNGPA and the continuation of compression required to transport the gas produced in the field. Noise-control devises already in place would continue to provide mitigation.

4.15.2 Alternative B—Proposed Action with Additional Mitigation

Direct and Indirect Impacts

Under this alternative, BLM would approve activities resulting in the construction of new federal wells or associated infrastructure on BLM-administered lands. In addition to the new drilling and production activity, the existing production operations in the BNGPA would continue. The direct effects of implementing this alternative would be the same as those described in Alternative A, but would include the construction, drilling, completion, and operation of 635 additional wells on BLM-managed lands and minerals for a total of 1,255 additional wells across the BNGPA.

Alternative B would add to the short-term noise generated during construction, drilling, and completion operations as well as the long-term increase in noise resulting from field truck traffic. To reduce the impact of noise generated by field traffic the following mitigation should be applied:

- Install remote monitoring systems (i.e. SCADA; Computer Assisted Operations, or CAO's), where feasible, within the BNGPA to mitigate the noise and disruptions associated with increased field truck traffic. Limitations to the feasibility of implementing this recommendation may exist due to the age of the field, the lack of appropriate infrastructure, and the remote nature of the area.

As discussed in Alternative A, the noise from construction, drilling, and completion activities would be relatively low and of short-term duration. Production of the natural gas resource using artificial lift systems (pump jacks or natural gas-fired progressive cavity pumping systems) and the operation of gas compression stations represents continual and dominant sound on the landscape. The majority of the compressor stations (Table 14.15-1) already meet the recommended standard of 55 dBA (with an average day/night noise level of 49 dBA) for noise impacts to sensitive receptors at ¼ mile from the source (Schomer 2005). This standard is also commonly applied by the BLM to compressor stations within oil and gas development projects (BLM 2003). The artificial lift systems currently being tested in the field may exceed this standard without the installation of muffler systems. The imposition of the 55/49 dBA standard on the compressor stations and artificial lift systems that currently exceed this noise level at ¼ mile would mitigate the noise impact to sensitive receptors located proximal to the equipment. Additional noise surveys should be conducted to verify the noise levels at ¼ mile for those stations that may be of concern. Sensitive receptors in the BNGPA include full-time residences, raptor nests, Greater sage-grouse or sharp-tailed grouse display areas (leks), big game winter range, and piping plover nesting areas. To reduce the impact of noise generated by the compressor stations, the following mitigations should be applied:

- Install noise mufflers on the exhaust of compressor engines and artificial lift systems to reduce exhaust noise.
- Where noise impacts to existing sensitive receptors are an issue, require that noise levels be no more than 55 decibels (with an average day/night noise level of 49 dBA) measured at a distance of one quarter mile from the compressor station. When background noise exceeds 55 dBA, noise levels will be no greater than 5 dBA above background at one quarter mile.

Indirect impacts of implementing Alternative B include the continuation of the production of the existing federal, fee and state wells in the BNGPA and the continuation of the noise mitigation already applied to some compressors in the system.

4.15.3 Alternative C—Maximum Development Alternative

Direct and Indirect Impacts

The direct impacts of implementing Alternative C, the Maximum Development Alternative, are the same as those described in Alternative B, but would include the construction, drilling, completion, and operation of 1,905 wells across the BNGPA, 650 more wells than Alternative B. In addition to the new drilling and production activity, the existing production operations in the BNGPA would continue. Alternative C would add to the short-term noise generated during construction, drilling, and completion operations and would continue the current level of gas compression-generated noise with the possibility that one additional compressor station and two station enlargements may occur. Noise as a result of the installation of artificial lift systems would increase and would continue for the life of the project. The management of noise would include the mitigation measures described in Alternative B.

Indirect impacts of implementing Alternative C include the continuation of the production of the existing federal, fee, and state wells in the BNGPA and the continuation of the noise mitigation already applied to some compressors in the system.

Cumulative Impacts

There are no other known planned developments within the project area that would increase background noise levels. Ambient noise would continue to be impacted by recreational and agriculture-related traffic through the area, continued gas production operations, livestock grazing and the wind.

4.16 UNAVOIDABLE ADVERSE IMPACTS

4.16.1 Alternative A—No Federal Action

Alternative A would disturb approximately 473 acres long-term, thus increasing the potential for wind and water erosion before the land is revegetated. Other unavoidable adverse impacts would be a long-term loss of vegetation and forage production, the loss of livestock forage, long-term turbidity and some sedimentation at local drainages, short- and long-term impacts to air quality/noise levels due to construction activities and operations, long-term loss of wildlife habitat, and possible temporary disruption of wildlife activities during construction. Under Alternative A, there would be reduced beneficial economic impacts to local, regional, and national economies.

4.16.2 Alternative B—Proposed Action, with Additional Mitigation

Alternative B would disturb approximately 945 acres long-term, thus increasing the potential for wind and water erosion before the land is revegetated. Other unavoidable adverse impacts would be as described above under Alternative A, but to a greater extent.

4.16.3 Alternative C—Maximum Development Alternative

Alternative C would disturb approximately 1,428 acres long-term, thus increasing the potential for wind and water erosion before the land is revegetated. Other unavoidable adverse impacts would be as described above under Alternative A, but to a greater extent.

4.17 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY

4.17.1 Alternatives A, B, and C

Short-term use of the environment would facilitate and enhance natural-gas production and stimulate local economies. Environmental impacts would be minimal; some would be short-term and others long-term. The proposed project would not adversely affect long-term use and would enhance long-term productivity related to natural gas supplies.

4.18 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

4.18.1 Alternatives A, B, and C

Irreversible or irretrievable commitments of resources would include the depletion of energy and, materials, and the manpower necessary to implement any of the Alternatives.