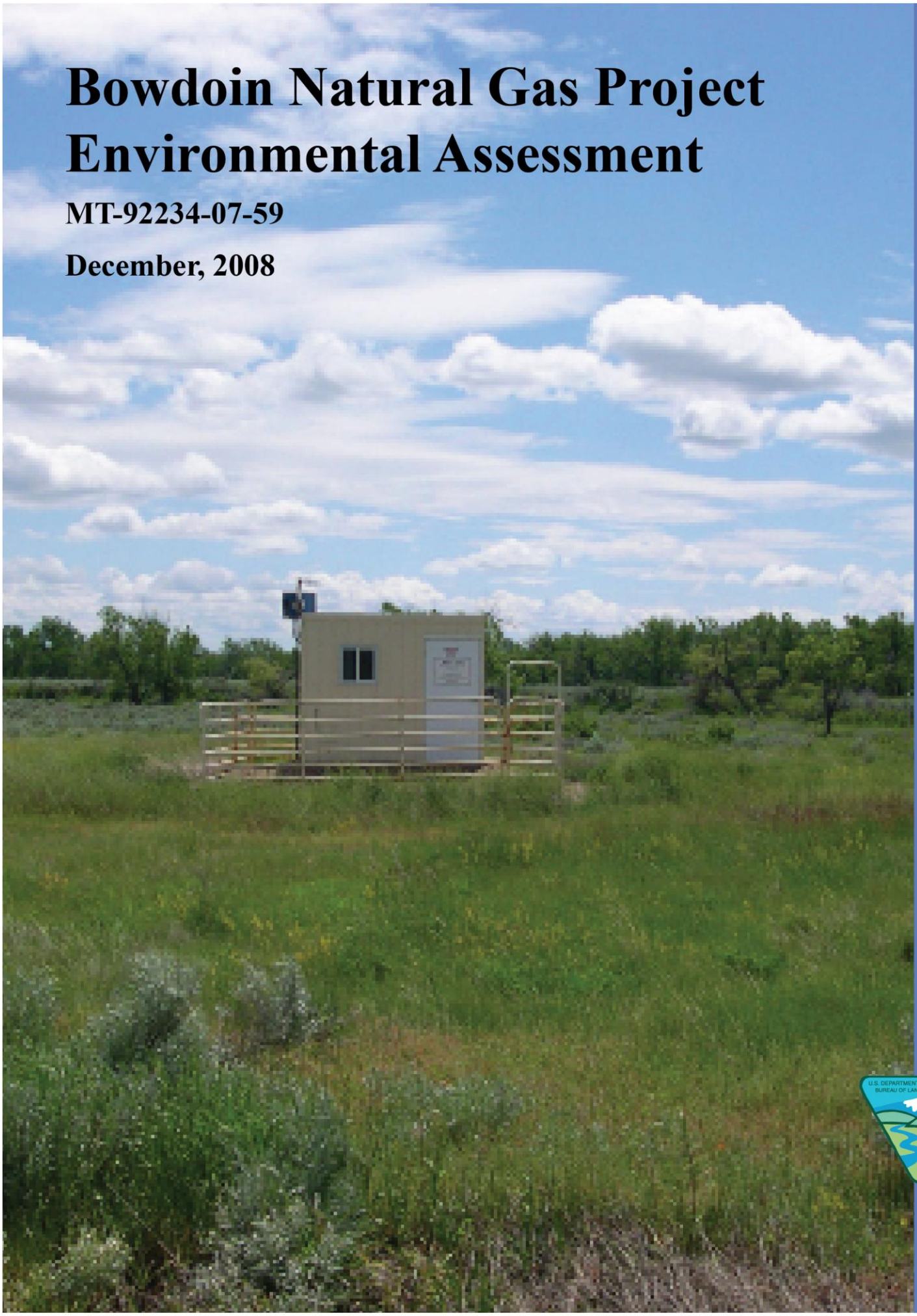
Bowdoin Natural Gas Project Environmental Assessment

MT-92234-07-59

December, 2008



BLM

MALTA FIELD OFFICE AND GREAT FALLS FIELD STATION

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

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BLM/MT/PL-08/013

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Acronyms and Abbreviations

bbls	barrels
Bcf	billion cubic feet
BWPD	barrels of water per day
CIAA	Cumulative Impact Assessment Area
DOI	U.S. Department of the Interior
dBA	decibels
dv	deciview
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
ERMA	Extensive Recreation Management Area
ESA	Endangered Species Act of 1973
F	Fahrenheit
FAS	fishing access sites
FEMA	Federal Emergency Management Act
Fidelity	Fidelity Exploration & Production Company
FLAG	Federal Land Managers' Air Quality Related Values Workgroup
FLPMA	Federal Land Policy and Management Act
FMDH	Frances Mahon Deaconess Hospital
FMR	federal mineral royalties
frac	fracture stimulation
ft	foot (or feet)
FWS	U.S. Fish and Wildlife Service
FY	fiscal year
GAP	Montana Gap Analysis Program
GFFS	Great Falls Field Station
GIS	geographic information system
g/hp-hr	grams per horsepower-hour
gpd	gallons per day
gpm	gallons per minute
GPS	Global Positioning System
HAP	hazardous air pollutants
HDPE	high-density polyethylene
hp	horsepower
H_2S	hydrogen sulfide
HUC	hydrologic Unit Code
HWA	Hayden-Wing Associates
ID	interdisciplinary
IDT	interdisciplinary team
IMPROVE	Interagency Monitoring of PROtected Visual Environments
in	inches
JVPRMP	Judith Valley Phillips Resource Management Plan
kg	kilograms
kg/ha	kilograms per hectare
km	kilometer

LOP	life of project
LOS	levels of service
m	meter
MAAQS	Montana Ambient Air Quality Standards
MBOGC	Montana Board of Oil and Gas Conservation
MCA	Montana County Noxious Weed Act
MCF	thousand cubic feet
mcfd	thousand cubic feet per day
mcfgpd	thousand cubic feet of gas per day
mg/l	milligrams per liter
MBDD	Montana Bird Distribution Database
MDEQ	Montana Department of Environmental Quality
MDEQ-ARMB	Montana Department of Environmental Quality – Air Resources Management Bureau
MDT	Montana Department of Transportation
MDU	Montana Dakota Utilities
MFO	Malta Field Office
MFWP	Montana Department of Fish, Wildlife and Parks
mm	millimeter
mph	miles per hour
mscfd	thousand standard cubic feet per day
MT	Montana, Montana State Highway
MTNHP	Montana Natural Heritage Program
N_2	nitrogen
NA	not applicable
NAAQS	National Ambient Air Quality Standards
NASIS	National Soils Information System
NEPDG	National Energy Policy Development Group
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO_x	nitrogen oxide
NO_2	nitrogen dioxide
NO_3^-	nitrate
NP	National Park
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NSR	New Source Review
NTL	Notice to Lessee
NTU	Nephelometric Turbidity Unit
NWR	National Wildlife Refuge
O_3	ozone
OSHA	Occupational Safety and Health Administration
pH	acidity measurement unit (negative logarithm of the hydrogen ion [H^+] concentration)
PEM	palustrine, emergent, seasonally flooded
$PM_{2.5}$	particulate matter less than 2.5 microns in effective diameter
PM_{10}	particulate matter less than 10 microns in effective diameter
ppm	parts per million
PSD	prevention of significant deterioration
RCRA	Resource Conservation and Recovery Act

RFD	reasonably foreseeable development
RMP	Resource Management Plan
RO	reverse osmosis
ROD	Record of Decision
rpm	revolutions per minute
RV	recreational vehicle
SAR	sodium absorption ratio
SARA	Superfund Amendments and Reauthorization Act
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SPCC	Spill Prevention Control and Countermeasures
SVR	standard visual range
TCF	trillion cubic feet
TD	total depth (well)
TDS	total dissolved solids
Thalweg	The line defining the lowest points along the length of a river bed or valley
TMDL	total maximum daily load
TNW	Traditionally Navigable Water
TPQ	threshold planning quantity
TSS	total suspended solids
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFS	U.S. Forest Service
USGS	United States Geological Survey
VOC	volatile organic compounds
VRM	visual resource management
WBIP	Williston Basin Interstate Pipelines
WSA	Wilderness Study Area
^{o}F	degrees Fahrenheit
µg/m3	micrograms per cubic meter

1. PURPOSE AND NEED

1.0 INTRODUCTION

Fidelity Exploration & Production Company (Fidelity), representing itself and five other Operators (Noble Energy, Inc.; Decker Operating, LLC; Omimex Canada, Ltd.; Athena Energy, LLC; and Bitter Creek Pipelines, LLC), has notified the United States Department of the Interior (DOI), Bureau of Land Management (BLM), Great Falls Field Station (GFFS) of its intent to drill additional exploration and development wells in the Bowdoin Natural Gas Project Area (BNGPA).

1.1 PROJECT DESCRIPTION AND LOCATION

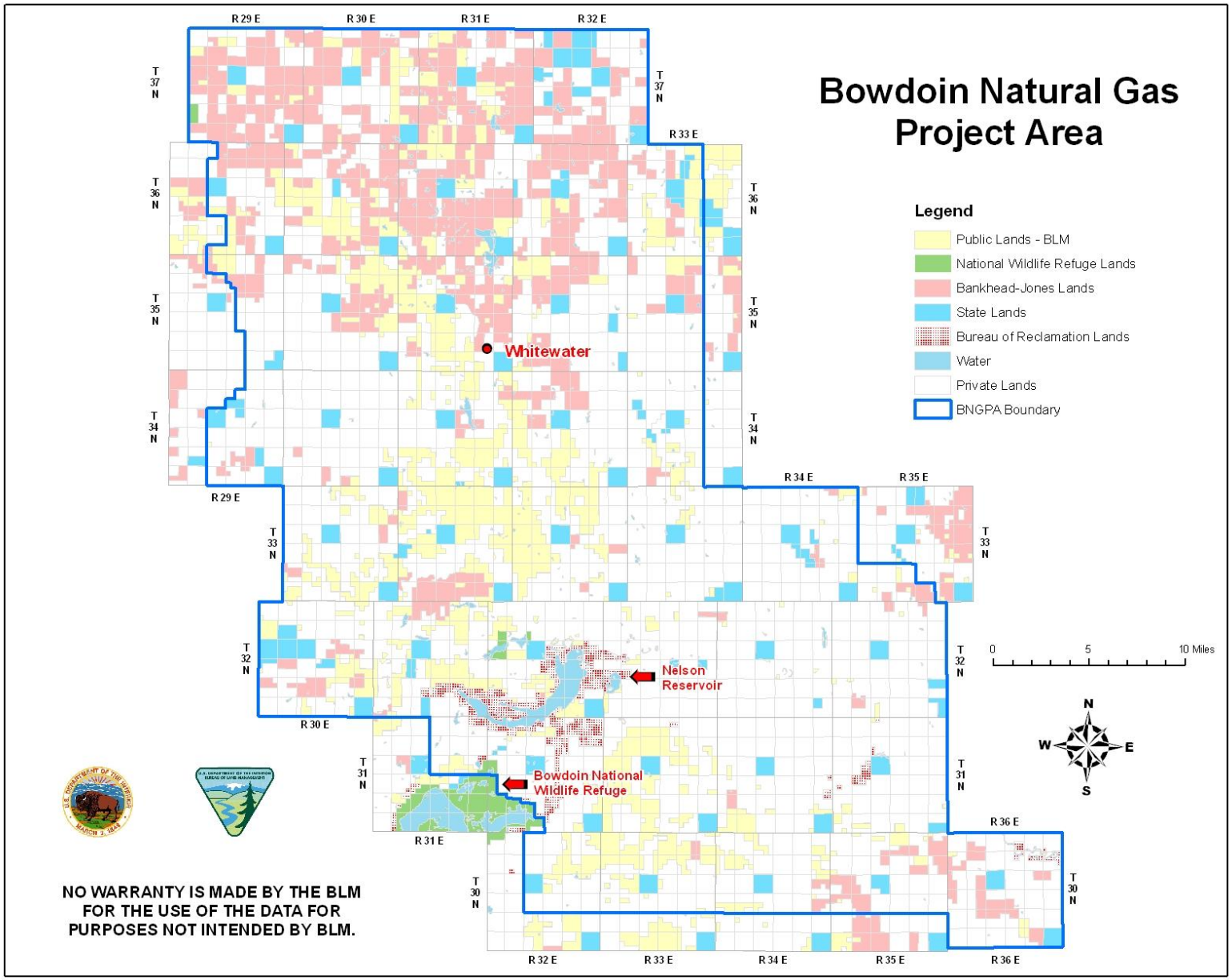
The proposed BNGPA is generally located in Townships 30 through 37 North, Ranges 29 through 36 East, in Phillips and Valley counties, Montana, as shown in Figure 1.1-1. The project area is entirely within the Malta Field Office and Great Falls Field Station management areas.

The BNGPA presently contains several active fields which are predominantly spaced at four (4) wells per section for drilling of the Upper Cretaceous including, but not limited to the Niobrara, Bowdoin (Carlile), Greenhorn, Mowry, Phillips, and Belle Fourche Formations (a/k/a Colorado Group). Some sections within the BNGPA currently have eight wells per section approved, or 80-acre spacing. A previous operator, Freeport McMoran, appeared before the Montana Board of Oil and Gas Conservation (MBOGC) in 1992 and 1993 to obtain formal approval for these wells. Eighty-acre spacing is not part of the Proposed Action to be analyzed in this document. This area contains several active federal units. The BNGPA has approximately 1,500 active producing gas wells, with accompanying production-related facilities, roads, artificial lift devices, and pipelines. The project area consists of approximately 813,000 acres, with surface ownership of 33 percent federal, 61 percent private, and 6 percent State of Montana.

For purposes of conducting an environmental analysis, the Operators have indicated that an additional 140 exploratory wells (80 federal), 680 development wells (340 federal) and 435 replacement wells (215 federal) may be drilled at individual locations in the BNGPA. Replacement wells are wells that replace existing producing wells. The existing wells will be plugged and abandoned and the respective locations will be reclaimed or reused. However, 10 percent of the proposed development wells are high geological risks and are dependent on success. Drilling is expected to last for approximately 10 to 15 years, with a life-of-project (LOP) of 30 to 50 years.

The BNGPA is currently accessed by an existing road network developed to service existing drilling and production activities. Drilling any additional wells within the analysis area may require the construction of additional roads. The gas produced within the BNGPA would be transported by existing pipelines and new pipelines, including an upgraded gathering system with tie-ins to existing interstate pipelines. Additional new compression and produced-water evaporation pits are also proposed.

Figure 1.1-1. General Location Map, Bowdoin Natural Gas Development Project



1.2 PURPOSE OF AND NEED FOR ACTION

Exploration and development of federal oil and gas leases by private industry, including transport and delivery of produced oil and gas, is an integral part of the BLM's oil and gas program under authority of the Mineral Leasing Act of 1920 as amended; the Mining and Minerals Policy Act of 1970; the Federal Land Policy and Management Act of 1976; the National Materials and Minerals Policy, Research and Development Act of 1980; and the Federal Onshore Oil and Gas Leasing Reform Act of 1987.

The proposed project will assist in the exploration and supply of natural gas necessary to meet the nation's growing demand for U.S. domestic gas production. Projections indicate that demand for natural gas will increase from the 2002 level of 18 trillion cubic feet (TCF) to 21 TCF in 2025. The remaining demand will be met by imports of foreign natural gas, primarily from Canada. A portion of the increase in domestic supply is projected to be met by growth in production from the Rocky Mountain region. In addition, the Report of the National Energy Policy Development Group (NEPDG) states that 90 percent of electric power generation capacity additions between 1999 and 2020 are projected to be natural-gas fueled. The quantity of natural gas consumed for power generation is expected to triple from 1999 to 2020 (NEPDG, 2001). Natural gas production from the Bowdoin Natural Gas Development Project would help meet this demand.

The purpose of the project, as described by the Operators, would be to allow the Operators to produce natural gas from existing leases in the Bowdoin natural gas field for the long term (approximately 30 to 50 years), deliver to multiple markets, and provide for the sale of developed minerals.

1.3 PURPOSE OF THE ENVIRONMENTAL ANALYSIS PROCESS

The BLM, Malta Field Office and Great Falls Field Station, is the lead agency responsible for preparation of this EA.

The evaluation of this proposal and alternatives was developed through interdisciplinary field review with representatives from the Operators, the BLM, and the project interdisciplinary team (IDT). In addition, for purposes of this EA, reference to the Operators as the project proponent includes all contractors, subcontractors, or other parties that would be involved in the design, layout, and operation of the proposed Bowdoin Natural Gas Development Project.

The BLM, as authorized by the Council for Environmental Quality (CEQ) and the National Environmental Policy Act (NEPA) directives, analyzes actions involving federal lands to determine their impact on the human environment (40 CFR, Parts 1500-1508). Prior to issuing decisions on the proposal, the BLM must comply with the requirements of NEPA. NEPA requires federal agencies to use a systematic, interdisciplinary approach to ensure the integrated use of natural and social sciences in planning and decision-making. NEPA also directs that an environmental analysis of proposed federal actions must be completed to determine reasonable alternatives and effects of the federal action on the environment. The analysis is to determine whether approval of the Proposed Action would constitute a 'major' federal action significantly affecting the human environment. An IDT conducted the evaluation of the Proposed Action and project alternatives with representatives from the BLM and a third-party contractor approved by and working under the direction of the BLM.

Factors considered during the environmental analysis process regarding the project include a determination of whether the proposal and alternatives are in conformance with the following:

- BLM policies, regulations, and approved resource management plan direction; and
- policies and regulations of other agencies likely associated with the project.

This EA is not a decision document. It documents the process used to analyze the potential impacts of the Proposed Action and alternatives and discloses the effects of the Proposed Action and alternatives to that action. A Decision Record (DR), signed by the responsible official (Field Station Supervisor, Great Falls, and Field Manager, Bureau of Land Management, Malta Field Office) will document the final decision regarding the selected alternative. The BLM will document whether or not significant impacts would occur with implementation of any of the alternatives. If the BLM determines that no significant impacts would occur, a Finding of No Significant Impact (FONSI) Decision Record would be issued. If significant impacts are identified, the BLM decision would be to complete an Environmental Impact Statement (EIS), with subsequent public input and additional analysis of the alternatives. The BLM decision will relate to BLM-administered lands. Decisions by the responsible official regarding the use of transportation networks in the project area by the Operators may affect private land-owners, county administration of these roads, and public access to BLM-administered lands.

1.4 RELATIONSHIP TO POLICIES, PLANS, AND PROGRAMS

1.4.1 Conformance With Land Use Plan

The *Judith Valley Phillips Resource Management Plan* (JVPRMP), approved in September 1994, provides management direction for resources contained within the Bowdoin Natural Gas Development Project. The best management practices identified in Appendix A of the JVPRMP are applicable to this proposal. These practices apply to all surface-disturbing activities. The proposed development is in conformance with the JVPRMP. The environmental analysis that will be prepared on the Bowdoin proposal will incorporate appropriate decisions, terms, and conditions of use described in the JVPRMP.

1.4.2 Relationship to Other Plans and Documents

The Proposed Action would comply with all relevant federal, state, and local laws, the Phillips and Valley counties land use plans, and *Surface Operating Standards and Guidelines for Oil and Gas* (the Gold Book).

The *Environmental Assessment for Proposed FMP Operating Company Drilling Program in the Loring Unit, East Loring Field, West Loring Field, Whitewater Unit, East Whitewater Field, Swanson Creek Field, Ashfield Unit, Hinsdale Unit, and the Bowdoin Unit* (BLM 1989) was approved on May 10, 1989, and provided an analysis of the environmental impacts of proposed natural-gas development in the above-mentioned units and fields. The BLM's decision allowed natural-gas development to occur up to a spacing of four wells per section subject to prescribed stipulations.

The Master Application for Permit to Drill (APD), titled *Fieldwide Drilling Operations Plan for Drilling and Surface Use for All Fields/Units/Leases (Federal) in Phillips County and All Fields/Units/Leases West of Hinsdale in Valley County*, is dated March 21, 2005 (see **Appendix A**). The document includes detailed requirements for well site location, drilling and surface operations, maintenance, mitigation, well abandonment, and reclamation.

Use Authorizations—Use authorizations (i.e., rights-of-way, permits, etc.) for well pads, roads, pipelines, and well site facilities would be processed through the BLM APD and Sundry Notice permitting process when located on-lease. If and when additional power lines are needed for electricity used in natural gas production, the respective Operator would make a site-specific proposal. Any activity located off-lease would require an approved right-of-way.

Lease Stipulations—Some leases within the proposed area include special stipulations on occupancy. These are in addition to the standard lease terms. These stipulations are designed to protect surface resources such as soils, water, and wildlife by restricting periods of activity and areas of disturbance. Application of these lease stipulations will be handled on a case-by-case basis for each APD submitted to the BLM. **Appendix A** details APD stipulations that would be applied to all wells in the BNGPA.

1.5 DECISIONS REQUIRED

1.5.1 Montana Board of Oil and Gas Conservation

Decisions to be made by the MBOGC include whether to approve the APDs for fee wells and state wells or to modify the proposals with mitigation measures.

1.5.2 Bureau of Land Management

BLM must determine whether to:

- approve the Proposed Action,
- approve individual federal components of the Proposed Action (as presented in Table 2.3-1), or
- modify the Proposed Action with mitigation measures and monitoring activities that may be necessary for federal actions in addition to those measures proposed by the Operator.

BLM will not make decisions on construction, well drilling, or completion and production for any private and state wells, or their supporting infrastructure. The Montana Department of Environmental Quality (MDEQ), Department of Natural Resources and Conservation (DNRC) and MBOGC have jurisdiction over their individual components of this project. Their respective decisions have been incorporated into Section **1.4.2**, **Relationship to Other Plans and Documents**.

1.6 ISSUES AND CONCERNS

Public issues and comments regarding the Bowdoin Natural Gas Development Project proposal were solicited for incorporation in this EA through the scoping process. A Scoping Statement that described the actions to be analyzed was prepared and submitted to the public on March 27, 2006, with comments due no later than May 1, 2006. The statement identified preliminary land and resource management issues, concerns, and opportunities, and outlined timing needs for public involvement. Environmental and social issues of local importance associated with natural gas production, gathering, and treatment were identified as follows:

- Potential impacts to wildlife habitats within the analysis area, including big game winter range, sage grouse, and raptors
- Potential impacts from road development, increased traffic, and associated impacts on existing county, state, private, and BLM roads
- Potential social and economic impacts
- Potential impacts to surface and groundwater resources
- Potential impacts to steep slopes and sensitive soils within the project area
- Potential impacts from emissions resulting from additional drilling and production activities
- Reclamation of disturbed areas and control of noxious weed invasions
- Potential conflicts with livestock management operations in the analysis area, including possible impacts to range improvements
- Potential impacts to cultural and historical resources within the analysis area
- Potential impacts to Native American sacred sites and Traditional Cultural Properties
- Potential impact to listed, or proposed for listing, plant and animal species
- Cumulative effects of drilling and development activities when combined with other ongoing and proposed developments on lands adjacent to the Bowdoin project area
- Potential impacts to recreation
- Potential impacts to paleontological resources

1.7 AUTHORIZING ACTIONS

The proposed federal, state, county, and local actions required to implement the Bowdoin Natural Gas Development Project are listed in Table 1.7-1.

Table 1.7-1. Federal, State, and County Authorizing Actions

AGENCY	NATURE OF ACTION
DEPARTMENT OF THE INTERIOR	
Bureau of Land Management (Great Falls Field Station and Malta Field Office)	• NEPA compliance and approval of APDs for wells and right-of-way applications for pipelines, compressor stations, power lines (as needed), and temporary use permits. Approval of disposal of produced water on federal lands. Coordination with Bureau of Reclamation (BOR) on BOR-managed lands. • Coordination with Fish and Wildlife Service (FWS) on FWS-managed lands. • Coordination with Montana Fish, Wildlife and Parks (MTFWP) on MTFWP-managed lands.
U.S. Fish and Wildlife Service	Coordination, consultation, and impact review on federally listed or proposed for listing, threatened or endangered species of fish, wildlife, and plants. Migratory bird impact coordination.
U.S. ENVIRONMENTAL PROTECTION AGENCY	
	• Spill Prevention Control and Countermeasures (SPCC) Plans. • Regulate hazardous waste treatment, storage, and/or disposal.
DEPARTMENT OF THE ARMY	
U.S. Army Corps of Engineers	Issue permits(s) (Section 404) for placement of dredged or fill material in or excavation of waters of the U.S. and their adjacent wetlands.
MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY	
Permitting and Compliance Division	• Montana Pollution Discharge Elimination System (MPDES) permits for discharging waste water and storm water runoff. • Conformance with all surface water standards; permit to construct and permit to operate. • Administrative approval for discharge of hydrostatic test water. • New Source Review (NSR) Permit: All pollution emission sources, including compressor engines and portable diesel and gas generators.
MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION	
Water Resources Division	• Issue permits to appropriate groundwater and surface water. • Issue temporary water rights for construction permits to appropriate surface water.

AGENCY	NATURE OF ACTION
Montana Board of Oil and Gas	• Primary authority for drilling on state and privately held mineral resources and secondary authority for drilling on federal lands. • Authority to allow or prohibit flaring or venting of gas on private or state owned minerals. • Regulate drilling and plugging of wells operating on private or state-owned minerals. • Aquifer Exemption Permit. • Directional drilling. • Rules and regulations governing drilling units. • Gas injection well permits. • Permits to construct settling ponds and waste water systems, including groundwater injection and disposal wells. • Regulate disposal of drilling fluids from abandoned reserve pits. • Disposal of produced water on state and private lands.
MONTANA STATE HISTORIC PRESERVATION OFFICE	
	Consultation concerning identification, evaluation, assessments effect and treatment of adverse effects on historic properties.
PHILLIPS AND VALLEY COUNTIES	
	• Zoning certificates for site development and construction. • Small wastewater system permits, where applicable. • Road use agreements and/or oversize trip permits when traffic on county roads exceeds established size and weight limits or where the potential for excessive road damage exists. • Construction and conditional use permits for all new structures. • Zoning changes where applicable. • Control of noxious weeds. • Permits to bore or trench county roads or for any crossing or access off a county road.
MONTANA DEPARTMENT OF TRANSPORTATION	
	• Conformance with applicable size and weight limits for trucks. • Encroachment permits.

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.0 INTRODUCTION

This section describes the alternatives developed to address the issues, and presents a comparison of the alternative features and a summary of the effects that would result from implementing each alternative. Section 2.2 presents these alternatives in detail.

2.1 DEVELOPMENT OF ALTERNATIVES

Alternatives present different management options in response to the purpose and need for the Proposed Action and address the relevant issues related to the Proposed Action. The development of alternatives to the Proposed Action is critical to the complete and thorough implementation of NEPA and its accompanying regulations. In accordance with 40 CFR 1502.14(a), the BLM is required to sharply define issues and evaluate all reasonable alternatives. The Proposed Action calls for developing oil and natural gas reserves from federal lands within the BNGPA. There are numerous methods by which this goal could be reached, although not all methods are technically or economically feasible. Alternatives to the Proposed Action were based on input from the Operators, the BLM, and the public.

The effects analysis (Section 4) describes the known or potential effects that would result if the alternatives were implemented.

Alternative A is the No Federal Action Alternative. The private and state wells and associated infrastructure would be developed in the project area. The BLM would not approve the federal wells or associated infrastructure. This alternative limits natural gas production and development to private and state land and minerals only, in order to reduce the overall potential impacts to water, wildlife, and cultural resources.

Alternative B is the Proposed Action with Additional Mitigation. The Operators' proposed project would be approved for the private, state, and federal wells and construction of the associated infrastructure. Mitigating measures that are not already part of the Operators' proposal have been included as part of this alternative. This alternative was developed to analyze full implementation of the Operators' proposal, while incorporating mitigating measures identified during project review that would avoid or reduce impacts to area cultural and natural resources.

Alternative C is the Maximum Development Alternative. This alternative was developed to assess effects of more development than either A or B.

2.1.1 Alternatives Considered but Eliminated from Detailed Analysis

Several additional alternatives were considered, but were not further evaluated for reasons described below.

Directional/Horizontal Drilling

Directional/horizontal drilling can only be considered a viable alternative if the method and geological environment meet the several technical and economic requirements to overcome the challenges of applying this technique to Upper Cretaceous formations within the BNGPA. The limitations of directional drilling are primarily dependent on maximum hole angle, rate of angle change, and friction considerations. The critical components to be considered in determining whether a well can successfully be drilled and completed as a directional well are:

- depth of well to the potentially productive zone;
- type of anticipated product (oil, gas, condensate, or combination) in combination with reservoir pressures and the applicability of directional/horizontal drilling to each respective formation;
- reservoir/formation characteristics (formations suitable for directional/horizontal well completions); and
- multiple-zone completions.

It is apparent that not all fractured reservoirs benefit economically by the application of this technology.

The downhole assembly/stimulation needed to produce the well can limit the use of directional/horizontal drilling. The Operators need to assess the presence of a number of critical reservoir, operational, and well design parameters. The two most critical reservoir performance parameters are the reservoir thickness and vertical-to-horizontal permeability ratio.

The oil and gas resources of the Bowdoin Dome have been known since before World War I. Natural gas was discovered in 1913 with production beginning the same year. Natural gas production was very limited until 1929, and by the end of 1930, there were approximately 25 producing natural gas wells that serviced Glasgow and Malta. As discussed on page 3-43 and reflected in Table 3.8-2, natural gas production in the BNGPA has been taking place for several decades. Production on this structure is chiefly from relatively shallow (less than 3,000 feet) reservoirs in the Upper Cretaceous Carlile Shale, Mowry and Greenhorn Formations, and Belle Fourche Shale, and is from a combination of stratigraphic and structural traps. In the BNGPA, production from the Carlile Shale comes from the Bowdoin Sandstone, a facies equivalent of the shale that reaches about 300 feet in thickness near the town of Mosby. The Greenhorn Formation is about 250 feet thick in the Bowdoin Dome area, where it is a principal gas-producing unit. The Mosby Sandstone Member of the Belle Fourche Shale is known as the Phillips Sandstone on Bowdoin Dome, where it is a major gas-producing unit.

Directional and horizontal drilling was also eliminated from detailed analysis due to the technical viability of drilling such a well. The formations within the BNGPA are stack reservoirs that are completed within the same well bore. The BNGPA has up to five zones of interest. A vertical well is the only economic way to commingle and produce these five zones in one well bore. In most cases directional/horizontal wells are significantly longer than conventional vertical wells are deep. This is required so the drainage points of the reservoir are evenly distributed to maximize resource recovery. Longer wells do create a problem as more reservoir energy is required to move the gas through the longer pipe to the surface. In most (if not all) Rockies reservoirs, the reservoir energy is depleted as the resource is recovered. Based on these principles, a shallower vertical well would flow longer than a directional/horizontal well, given the

same reservoir energy. For most energy depletion reservoirs, vertical wells that are spread optimally in the reservoirs will effectively recover more natural gas reserves.

During the last three years directional drilling techniques have been utilized in approximately one-third of the wells in the nearby Bear Paw South Field to facilitate resource recovery in areas with significant faulting and/or topographic challenges. These wells are relatively shallow with measured depths of 2,500–3,000 feet and true vertical depths around 2,000 feet. Typically the well bore deviation does not exceed 45 degrees due to operational concerns and the bottom-hole location has a reach of 500–1,000 feet from the surface location.

Directional drilling is not practical in the BNGPA for the same reasons as horizontal drilling. As an example, a BNGPA well at 2,000 feet requires a 200-foot surface conductor casing. If drilling to a 160-acre location from the center of a 160-acre location, a horizontal displacement of 933 feet must be achieved. The necessity of starting the curve of the horizontal displacement below the casing shoe of the conductor pipe would require the well bore inclination to be greater than 45 degrees from vertical, which brings the problem of artificial lift placement into question again.

Central Pad Multi-Well

The alternative of directionally drilling several wells from one central location was also considered. In addition to the limitations already discussed above, this central multi-well location requires a much larger footprint that is equal to or larger than four single-well pads. The access road to a multi-well pad facility must be upgraded to handle three times the normal traffic of a single-well pad. Consideration must also be given to the fact that the drilling rig would be in operation three times longer than for a single well.

Maximization of resource recovery is a significant consideration. The optimum method of recovering reserves is an important factor in selecting the appropriate methodology for unique reservoir conditions, as well as for minimizing the reserves left behind.

The formations within the BNGPA are stack reservoirs that are completed within the same well bore. The BNGPA has up to five zones of interest. A vertical well is the only economic way to commingle and produce these five zones in one well bore.

The wells in the BNGPA are not deep enough to share a single pad for multiple wells. It is not possible to achieve a high enough angle to reach the reservoir’s optimum depletion spacing.

Produced-water Disposal and Treatment Options

Discussed below are the various water-disposal scenarios that were considered for the Bowdoin Natural Gas Project. These water-handling alternatives were considered but were not analyzed in detail for this EA. Typically, the amount of produced water within the BNGPA averages less than five barrels/day/well (BWPD). Wells converted to artificial lift may produce up to 15 BWPD. This relatively small amount of produced water would not necessitate the installation of a gathering system to collect the produced water from each location for transportation to one or more centrally located treatment and disposal facilities. The cumulative economic and environmental effect of the installation of produced-water gathering and treatment facilities makes the concept unfeasible. All practical water-disposal methodologies were considered but are not being proposed as the primary method of handling produced water at this time. The considered methodologies include re-injection, treatment and surface discharge, surface discharge without treatment, and land application. In the future, the increased use of artificial lift production systems in the field may significantly increase the volume of water produced and necessitate the evaluation of produced-water management alternatives including a gathering

system to replace truck transportation to centralized facilities designed to manage water from numerous wells producing greater than five BWPD.

Re-injection: This method of produced-water management is not viable because of the environmental disturbance as described above. In addition, geological conditions within the BNGPA do not offer any known zones capable of taking produced water for a period of time sufficient to support the cost of installation of the required re-injection infrastructure.

Conventional Surface Discharge of Untreated Water: This method of disposal would not be widely permitted in the BNGPA due to naturally occurring salinity in the produced water. While a few natural gas wells within the area would meet the 'freshwater discharge' criteria, most would not.

Land Application: In this disposal method, treated (and in some cases, untreated) water is disposed of on the land surface and consumed by evapotranspiration. Typically, the water is applied using spray irrigation equipment (i.e., center pivot or side-roll systems). This method of disposal must be curtailed during winter months and as a consequence, storage is required during the winter. Land application is limited by the presence of well-drained, low-clay-content soils which are less susceptible to reduction in infiltrative capacity through the application of produced water. Use of this method of disposal is limited, and additional review and studies of land application would be considered by the respective agencies before issuing these types of irrigation permits.

Treatment: Salinity and sodium absorption ratio (SAR) have been identified as the primary concerns in natural-gas-produced water. These parameters are related to irrigation. Existing treatment technologies such as reverse osmosis and ion exchange have been tested to condition natural-gas-produced water to make it suitable for irrigation.

In the reverse osmosis (RO) procedure, the natural-gas-produced water is forced through a semi-permeable membrane using a high-pressure pump. The term 'osmosis' refers to the natural tendency for a solvent (in this case, water) to move through a membrane from a solution with a low solute (salt) concentration to a solution with a high solute concentration. By applying pressure to the concentrated side of the membrane, it is possible to reverse this phenomenon and force the water from a higher salt solution to a lower salt solution; hence, reverse osmosis.

In a typical application, RO may remove 95 percent or more of the salts from the raw water. This high salt-removal rate is attractive for a water supply system, where the total dissolved solids (TDS) of the treated water should be well below 500 parts per million (ppm). For BNGPA-produced water, however, 95 percent salt removal is excessive and cost-prohibitive at this time. This water would be so pure that it would rapidly accumulate salts if discharged to the ground surface. Typically, treated water is mixed with raw water to produce an effluent that is comparable to native surface waters. RO results in a brine stream of 20 to 50 percent of the volume of the influent stream, depending upon the efficiency of the RO filter. The RO brine stream would likely be disposed of in an approved injection well. Currently, there is neither an approved injection well nor a geologic formation capable of being approved for injection within the BNGPA or within its proximity. Again, low volumes of water produced in the BNGPA do not warrant a sophisticated disposal system that would also be cost-prohibitive.

In ion-exchange treatment, natural-gas-produced water is passed over a resin bed that exchanges positively charged ions in the raw water for hydrogen ions. The resulting high concentration of hydrogen ions creates a low pH (i.e., acidic) effluent that is buffered to a neutral

pH with calcium carbonate. The ion-exchange process typically reduces both TDS and SAR. The process results in a brine stream that, depending upon the efficiency of the ion-exchange process, can be as little as one percent of the influent stream. The brine stream must be disposed of in an approved injection well.

2.2 DESCRIPTION OF THE ALTERNATIVES

A comparison of the major components for the three alternatives is found in Table 2.3-1. A detailed description of each alternative follows.

2.2.1 Alternative A—No Federal Action

The No Federal Action Alternative is required under the President's Council on Environmental Quality (CEQ), 40 CFR 1502.14(d), and applicable BLM implementing regulations. The No Action Alternative provides a benchmark, enabling decision-makers to compare the magnitude of environmental effects of the action alternatives. Under the No Action Alternative, the BLM would reject the Operators' proposal to develop natural gas in the BNGPA as described in the Proposed Action. Rejection of the Operators' proposal would not be a rejection of all oil and gas development activities in the area, as the BLM would not have approval authority on fee and state wells except in the case of reverse split-estate lands (federal surface and fee or state minerals).

The analysis of the No Federal Action Alternative includes the development and production of wells and infrastructure associated with the proposed fee and state wells (558 private and 62 state) in the BNGPA. No approval would be issued by BLM under this alternative for the wells and facilities associated with federal leases. Figure 1.1-1 shows the project boundary and land-ownership for the BNGPA. Figure 2.2-1 shows the existing oil and gas infrastructure in the BNGPA.

The No Federal Action Alternative includes these elements: the MBOGC would approve the drilling, completion, and production of 558 private wells and 62 state wells; construction of associated infrastructure of access roads, flowlines, and power lines (approved on a site-specific basis as needed for electricity to produce the natural gas); reclamation of disturbed areas; 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). Of the 620, 220 would be replacement wells at a legal location within the applicable 160-acre spacing unit. The average life of the project is expected to be 30 to 50 years with final reclamation to be as specified in **Appendix D—Reclamation Plan**. Components of the proposed project are listed in Section 2, Table 2.3-1.

2.2.2 Alternative B—Proposed Action with Additional Mitigation

The Operators' proposed BNGPA development is the Proposed Action alternative. The plan describes the project and Best Management Practices (BMPs) designed to implement the project. The analysis of Alternative B includes the development and production of wells and infrastructure associated with the proposed federal, private and state wells (635 federal, 558 private, and 62 state; see Table 2.3-1) in the BNGPA.

The Proposed Action includes the drilling, completion, and production of 635 federal, 558 private, and 62 state wells; construction of associated infrastructure of access roads, flowlines, and power lines (approved on a site-specific basis as needed for electricity to produce the natural gas); reclamation of disturbed areas; 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). Of this total, 435 wells (215 federal, 22 state, and 198 private) would be replacement wells at a legal location within the applicable 160-acre spacing unit. The life of the project is expected to be 30 to 50 years, with final reclamation to be as specified in **Appendix D—Reclamation Plan**. Components of the proposed project are listed in Table 2.3-1.

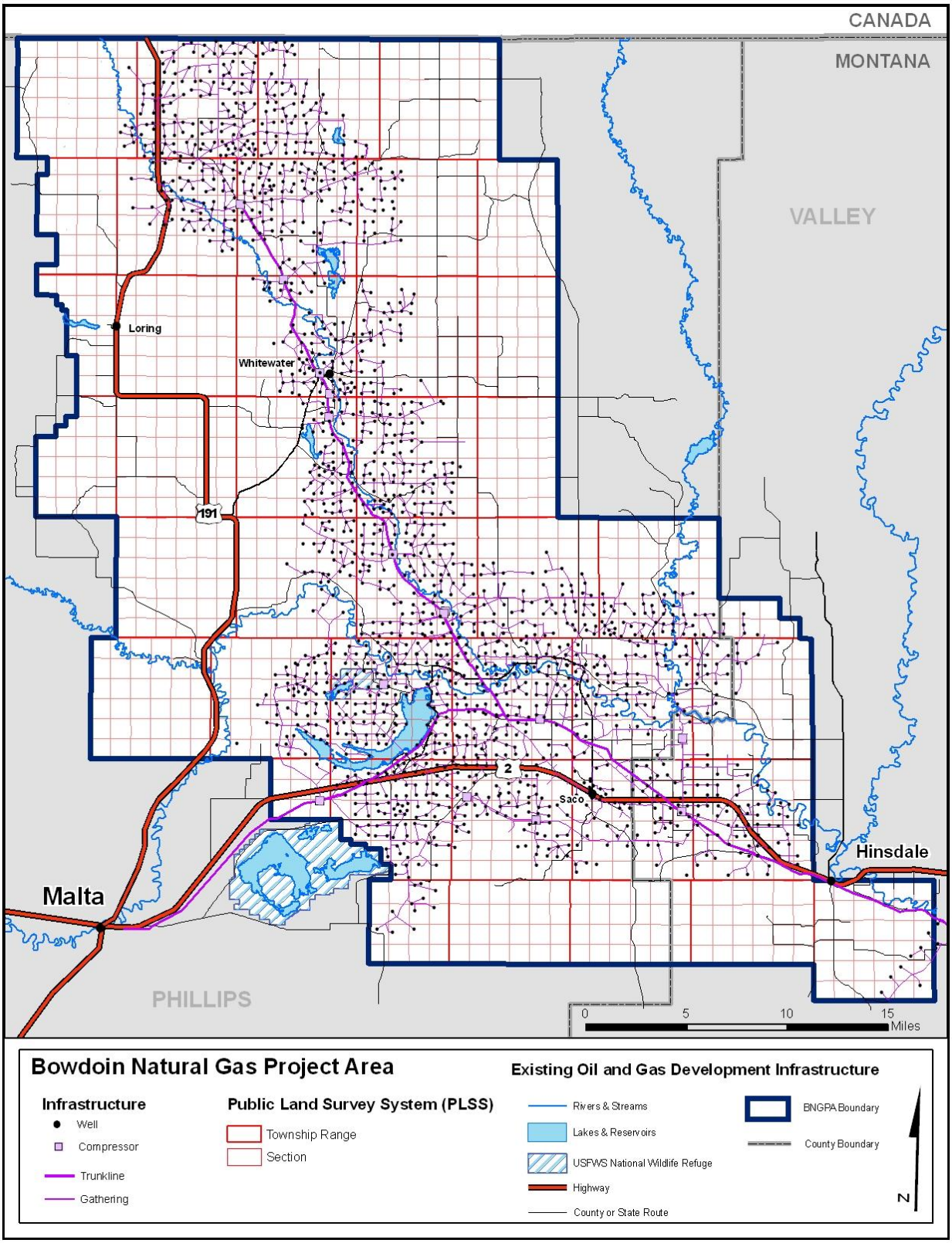
2.2.3 Alternative C—Maximum Development Alternative

A maximum development alternative has also been analyzed. The plan describes the project and BMPs designed to implement the project. The analysis of Alternative C includes the development and production of wells and infrastructure associated with the proposed federal, private, and state wells (964 federal, 847 private, and 94 state; see Table 2.3-1) in the BNGPA.

Alternative C includes the drilling, completion, and production of 964 federal, 847 private, and 94 state wells; construction of associated infrastructure including access roads, flowlines, and power lines (approved on a site-specific basis as needed for electricity to produce the natural gas); reclamation of disturbed areas; 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). Of this total, 660 wells (326 federal, 33 state, and 301 private) would be replacement wells at a legal location within the applicable 160-acre spacing unit.

The average life of the project is expected to be 30 to 50 years, with final reclamation to be as specified in **Appendix D—Reclamation Plan**. Components of the proposed project are listed in Table 2.3-1.

Figure 2.2-1. Existing Oil and Gas Infrastructure in the BNGPA



2.2.4 Project Description Common to all Alternatives

The following description of the project applies to all three alternatives.

Preconstruction

Development activities would be approved prior to initiation of construction through applicable permitting procedures including filing with BLM the appropriate right-of-way application with an applicable map.

The Operators would file all appropriate permit applications with the MBOGC. As more is learned about the gas resources in the BNGPA, MBOGC-specific spacing orders for the area could change and further development could be proposed.

Road Construction/Access

The Operators would use existing crowned and ditched roads within the BNGPA to the extent practicable, and construct new roads only where necessary to gain access to specific drill sites. Access road mileage and disturbance acres for the three alternatives would be as follows:

- **Alternative A.** Access would primarily use approximately 207.5 miles of existing and proposed two-track roads. The resulting surface disturbance would be 301.8 acres.
- **Alternative B.** Access would primarily use approximately 418.75 miles of existing and proposed two-track roads. The resulting surface disturbance would be 609.1 acres.
- **Alternative C.** Access would primarily use roughly 636 miles of existing and proposed two-track roads. The resulting surface disturbance would be 925.1 acres.

Surface Ownership of the project area is approximately 33 percent federal, 61 percent private, and 6 percent State of Montana. Access road mileage and surface disturbance shown above would be proportional to surface ownership.

Pipeline corridors would also be used as temporary roads for access to well sites when feasible. Culverts and/or low-water crossings would be installed at drainage crossings, if needed. Gravel needed for surfacing material would come from a pit permitted by MDEQ.

The road and pipeline routes are proposed as agreed to by the appropriate private-surface owner or state agency. Where possible, whether proposed two-track road or existing, the roads would serve as a common corridor for gas and electric lines. The project map (Figure 1.1-1) shows the project boundary, existing and proposed wells, access roads, pipelines, power lines, and the central gathering/metering/water-processing facilities in the project area. The location of roads and pipelines would be determined in the APD for each individual well. The Operators would construct any required access roads on federal surface in accordance with standards presented in BLM Manual Section 9113 (1985, 1991).

Well Pad

The Operators propose to utilize a traditional well pad design used in north-central Montana. Single-well pads would be approximately one acre in size. The actual disturbance for the drilling rig being utilized by the Operators in the area is 120 by 190 feet in size (approximately 0.52 acres). All available vegetation and topsoil would be salvaged and stockpiled for future reclamation operations. Erosion-control BMPs would be utilized on well pads to control

sediment movement off of the site. If less than six inches of topsoil are available, topsoil along with an appropriate quantity of other suitable spoil (with BLM approval) would be salvaged so that a minimum of six inches of plant-growth material would be available for use during revegetation operations. Topsoil and suitable subsoil piles would be constructed so as to minimize erosion to local drainage channels. Appropriate signs would be placed on all topsoil and suitable subsoil stockpiles. Soil that is not re-spread within 30 days would be covered with a tackifier, mulch, or other approved cover.

Well pads would be constructed and leveled using standard cut-and-fill construction techniques (see section **2.2.5**, **Applicant-Committed Mitigation**). Components of the well pad include a reserve pit and an emergency pit for emergency and development flaring. At each drilling location, drilling wastes including cuttings, water, and drilling muds would be placed into a reserve pit. Each pit would be approximately 12 feet wide by 60 feet long by 4 feet deep (for 1,000- to 1,500-foot total depth [TD] wells) or 6 feet deep (for 1,500- to 2,000-foot TD wells) and enclosed with a wire fence and/or fencing panels to keep out livestock and wildlife. After conclusion of drilling operations, fluids in the pits would be removed and either used for other drilling operations or disposed of properly. The pits would be backfilled after the remaining muds have dried. Wastes accumulated during drilling and completion operations would be contained on the well site and disposed at the Saco sanitary landfill. Toilet facilities would be provided for field operations. The locations would not be graveled, but left in a natural state. These locations would also be used during completion operations and then reclaimed to a smaller size, which is dependent upon the area needed for the produced-water evaporation pit. If warranted, the reserve pit would be lined with a 12-mil reinforced poly-liner to temporarily contain drilling fluids, cuttings, and produced water. The poly-liner would be impermeable (i.e., having a permeability of less than 10^{-7} m/sec) and chemically compatible with all substances that might be placed in the pit. Venting of any gas produced would be over an unlined emergency pit. All pits would be constructed in accordance with MBOGC requirements. Any drilling operations that require the use of exotic non-natural muds (e.g. oil-based mud, mineral oil, etc.) will require a closed-loop system in which the drilling mud will be completely contained. The preferred method of accomplishing this is to utilize steel tanks that adequately contain the mud.

Drilling

Each well drilled would require the transportation of approximately five truckloads of drilling-related equipment and materials. This would include the drill rig, drill pipe, drilling fluid products, and related support equipment. Additional vehicle traffic would also be required for the transportation of personnel and expendable supplies such as fuel, drilling fluid additives, water, etc. The specific amount of vehicle traffic would vary, depending on the progress of drilling operations, but would likely not exceed a total of 6–7 vehicle trips/day including rig transport over a two-day period for each drill site during drilling operations. Drilling depths would vary within the project area; however, wells would typically be 1,500-3,000 feet deep. Drilling each well would require 5,000 barrels (bbls) (210,000 gallons; 0.64 acre-feet) of water. Generally, water used for drilling would be purchased from an existing commercial water source. Drilling a gas well would typically take two days.

Wells would be drilled by conventional gas well-drilling rigs. After about three weeks of no activity, cased-hole logs would be run on the well, which would be completed in one day. The following casing program would be followed:

Surface Casing—Generally, a minimum of 100 feet (or 10 percent of the projected total depth of the well, whichever is greater) of 7-inch, 17 #/ft API-graded H-40 casing would be set. New limited-service pipe may be used for the surface casing, but would require prior approval by

BLM before being installed in a federal well. The surface casing would be set utilizing a minimum of 65 sacks of Class 'G' cement with reasonable necessary additives (this allows for 70 percent excess over the calculated annular volume). The surface casing would be cemented back to surface either during the primary cement job or by remedial cementing. Five bbls of fresh-water flush would be used ahead of cement when cementing surface casing. At a minimum, a top wiper plug would be used while displacing cement into place and would be displaced no closer than 30 feet from above the shoe. Surface casing would have a centralizer on each of the bottom three joints.

Production Casing—At a minimum, production casing would be consistent with 4½-inch, 9.5#/ft, J-55 casing. The production casing would be set utilizing a minimum of 11.5 sacks of class 'G' cement per 100 feet of hole, with reasonable necessary additives (this allows for 25 percent excess over the calculated annular volume at a cement yield of 1.15 cubic feet/sack). Higher-yield cement (i.e., 50-50 Poz) is allowed under this plan provided the cement would reach a compressive strength of 1,500 psi.

Cementing of production casing is not required; however, when this technique is utilized, the production casing would be cemented back to surface either by primary cementing or by remedial cementing. A best attempt would be made to assure that all productive intervals are isolated with good cement coverage around the pipe. This would be accomplished by placing centralizers at 100 feet above and below the productive interval and placing the centralizer every 100 feet between the top and bottom centralizer. Ten bbls of fresh-water flush would be used ahead of cement when cementing production casing.

Each well is typically drilled to approximately 400 feet deeper than the top of the Phillips/ Greenhorn formation or to the base of the Mowry formation. Production casing would then be run and the selected productive intervals would be jet perforated. Fresh water would be used in the drilling operations. All wells capable of commercial production would be completed and produced and the associated infrastructure would be constructed and installed.

Once the well is drilled and completed, normal traffic on the access road would include pumper vehicles and occasionally a water truck to remove production water from the well's evaporation pit.

Alternative A: 558 private wells would be drilled on 558 well sites and 62 state wells would be drilled on 62 well sites (see Table 2.3-1) with one well drilled on each well site at 160-acre site spacing (four wells per 640 acres). Anticipated depth of the wells would be from approximately 1,000 to 3,000 feet TD. The drilling period is anticipated to last 10–15 years.

Alternative B: 635 federal wells would be drilled on 635 well sites, 558 private wells would be drilled on 558 well sites and 62 state wells would be drilled on 62 well sites (see Table 2.3-1) with one well drilled on each well site at 160-acre site spacing (four wells per 640 acres). Anticipated depth of the wells would be from approximately 1,000 to 3,000 feet deep. The drilling period is anticipated to last approximately 10–15 years.

Alternative C: 964 federal wells would be drilled on 964 well sites, 847 private wells would be drilled on 847 well sites, and 94 state wells would be drilled on 94 well sites (see Table 2.3-1) with one well drilled on each well site at 160-acre site spacing (four wells per 640 acres). Anticipated depth of the wells would be from approximately 1,050 to 2,450 feet deep. The drilling period is anticipated to last approximately 10–15 years.

Completion, Testing, and Production

When necessary, well completion isolates aquifers with cemented surface and production casing to prevent mixing fluids between formations and to isolate production zones. The well is perforated using jet powder charges that burn designed holes through the casing and cement into the production zones, creating a path for fluid travel into the well bore. If the production zone or formation does not allow enough flow into the well bore for economic production, this zone is called 'tight.' A decision may be made to stimulate the production zone. Wells in the Bowdoin area are stimulated utilizing the fracturing technique. Fracturing is done by pumping fluid into the well bore with enough pressure to crack (fracture, or 'frac') the rock. Once this fracture is initiated, sand is added to the frac fluid and pumped into the fracture, which holds (props) the fracture open. The frac fluid is able to transport the sand because it includes a guar polymer-based viscosifier. The system used most frequently in the Bowdoin Dome is a simple fresh-water base with a polymer viscosifier, which is called a slick water or linear gel system. Once the fracture is completed the well is opened up through a choke and allowed to flow back the fracturing fluid into the reserve pit. Because of low reservoir pressures, nitrogen is added to the frac fluid, which creates foam to help energize the formation and aids in flow-back of the fluids and avoidance of a water block. This improves the ability to recover more of the frac fluid from the formation more quickly.

Once the well is drilled, completion operations would occur over a number of weeks. The completion time would be dependent on the number of zones being completed. Bowdoin-area wells are typically completed in one to five zones. It typically requires 11 days to complete one zone, although well site activity only occurs for four days out of the 11 and, in many cases, only for a matter of hours during those active days. Completion travel consists of 12 semi-truck-sized loads traveling three days out of 11 and a smaller number of trucks traveling two days for each production zone being completed.

During field operations, each well is visited at least once and sometimes twice each week by a fieldman or pumper to ensure the evaporation pits are not overflowing, there are no gas leaks, and the site is secure. Each fieldman typically visits 10–12 wells per day.

Pipeline Construction and Production

If testing indicates that a well would be commercially viable, flowlines and gathering lines would be installed. Where required, product lines would be connected with pumps/compressors that would be located within the BNGPA. Gas produced as a result of the proposed project would be transported by buried gathering lines and pipelines that would be installed adjacent to existing common corridors (e.g., roads, pipelines, and gathering lines) whenever practicable. Proposed flowlines (pipelines) to be installed would be 3.0-inch outside diameter (OD) plastic, 3- and 4-inch inside diameter (ID) steel. Plastic lines would be plowed to a minimum depth of 38" and all steel lines would be trenched to a depth of 42 inches. The typical right-of-way would be 50 feet in width and actual disturbed area during construction would be 25 feet in width for steel lines and approximately 5 feet for plowed plastic lines. Gathering companies are not required to perform hydrostatic testing; however, hydrostatic testing using water, gas, or air may be performed. In addition, leak testing may be performed by filling a pipe with gas or air and monitoring the pressure, typically for a period of 4–8 hours. Radiographic inspection of approximately 33 percent of welded steel lines would also be performed. Steel lines would be externally coated with fusion-bonded epoxy for corrosion protection. Line locations would be marked on the ground surface to prevent third-party damage.

Approximate surface disturbances due to flowline construction are shown by alternative in Tables 2.2-1 through 2.2-3. Note that these are short-term disturbances, which would be completely reclaimed after construction.

Table 2.2-1. Surface Disturbances due to Flowlines for Alternative A

Flowline Type	Length (miles)	Width (feet)	Disturbed Acres
Plowed	103.75	5	62.9
Ditched	103.75	25	314.4
Total			377.3

Table 2.2-2. Surface Disturbances due to Flowlines for Alternative B

Flowline Type	Length (miles)	Width (feet)	Disturbed Acres
Plowed	210	5	126.9
Ditched	210	25	634.8
Total			761.7

Table 2.2-3. Surface Disturbances due to Flowlines for Alternative C

Flowline Type	Length (miles)	Width (feet)	Disturbed Acres
Plowed	318	5	192.7
Ditched	318	25	963.6
Total			1,156.3

Surface ownership of the project area is 33 percent federal, 61 percent private, and 6 percent State of Montana. Flowline surface disturbance for each alternative would be proportional to surface ownership.

Once the flowlines (plastic and steel) are installed, rights-of-way would be backfilled and reseeded with a BLM-approved mixture or a different mixture if requested by the affected surface owner(s). The reclaimed rights-of-way would be monitored until vegetation is re-established. Erosion control would be installed where necessary. The gathering companies would utilize BMPs, such as straw-bale barriers and filter-fabric fence, as required to control erosion prior to the re-establishment of vegetation on disturbed surfaces. BLM-approved gates or cattleguards would be installed where needed for access. Flowlines crossing gravel roads would be installed in an open cut that would be backfilled; flowlines crossing highways would be installed by boring underneath the pavement. Irrigation canals would be open-cut when feasible or bored or flumed if not (dictated by Bureau of Reclamation). All steel lines would be cathodically protected.

Production and maintenance operations would occur on a year-round basis and would last for the LOP (30–50 years). Access roads to productive well sites would be maintained by the Operators to BLM standards, and would allow year-round access. Access roads would be inspected periodically by the Operators to minimize resource damage and ensure safe operating conditions. Production and maintenance operations would be conducted in accordance with industry standards for safety and efficiency.

Surface facilities at each producing well would consist of a wellhouse and possibly an artificial lift device (approximately 12 feet by 6 feet, 10 feet tall) enclosed in three-rail welded fence panels. The wellhouse would be painted a color to blend with the surrounding area. Approximately 70 percent of the new locations would have a 40-foot square evaporation pit, and 30 percent of the locations would have a 60-foot square evaporation pit. The area within the

fence would be graveled while the area outside the fence would be reclaimed after installation of production equipment. The existing field compressor sites would be utilized by this proposal.

Abandonment and Reclamation

All wells would be plugged in accordance with MBOGC or BLM (as applicable) rules and regulations. Site abandonment would include the removal and salvage of all above-ground facilities in accordance with the Sundry Notice, including production facilities and equipment, tanks, meters, etc. The BLM requires that drilling pits be pumped dry and either fenced or backfilled immediately upon well completion. The location of mud disposal for each well must be disclosed in the APD. If a liner has been used in the reserve pit, any liner material must be removed to below ground level before being covered (BLM 1989). BLM rules require earthwork for interim and final reclamation to be completed within six months of well completion or well plugging (weather permitting). Upon specific approval, reserve pit fluids could be allowed to dry by evaporation for approximately one year prior to reserve pit closure and drill site reclamation. When the pit is backfilled, cuttings and drilling muds would be covered to a depth of at least three feet. Produced-water evaporation pits would be handled similarly to reserve pits: fluids would be allowed to evaporate followed by any residual solids being buried under at least three feet of fill material. If drilling or production fluids remain in the pit after one year, alternate methods of drying, removal of the fluids, or other treatment measures would be implemented by the Operators in consultation with the BLM or MBOGC. Necessary permits would be acquired by the Operators if fluids were transported off-site for disposal.

Buried pipelines would be purged of combustible materials and abandoned in place. Following site abandonment, all well sites and roads would be abandoned and reclaimed unless they were determined to be left in place by the authorizing agency or private land-owner.

Reclamation operations would be conducted on all disturbed lands in accordance with MBOGC requirements and surface owner agreements. The short-term goal of reclamation would be to stabilize disturbed areas as rapidly as possible, whereas the long-term goal would be to return the land to conditions approximately equal to those that existed prior to disturbance. Reclamation would occur during two phases: interim and final. If production facilities were installed, reclamation of all disturbed areas not required for production operations would be initiated. Reclamation of all disturbed surface areas along pipeline rights-of-way would also be initiated as soon as practicable (see **Appendix D—Reclamation Plan** for complete details).

Interim reclamation would occur on areas that would be re-disturbed prior to final project abandonment (e.g., topsoil and suitable subsoil stockpiles). For well pad cut-and-fill slopes on producing wells, Operators may, after consulting with MBOGC, BLM, or surface owner (as applicable), elect to conduct either temporary or permanent reclamation. However, Operators would not use temporary reclamation as a means to delay permanent reclamation on areas that would not be re-disturbed.

Interim reclamation would include regrading and recontouring slopes to a 3:1 ratio or less. Regraded surfaces would be ripped between two and four inches below the bottom of a compacted layer, if necessary, to reduce soil compaction. Interim reclamation areas would then be seeded using a certified weed-free seed mix agreed upon with the surface owner, or specified by BLM.

Unused areas around well pads, unused pits, flowlines, pipelines, power lines to wells, cut-and-fill slopes of roads, and any other surfaces not required for field use would be graded to form stable, rounded slopes that blend with the natural terrain. Erosion-control structures and/or

sediment containment systems would be built or installed as needed, areas would be ripped, and temporary seeding would be completed. Seeding would occur within three months of completing construction or during the next seeding window, whichever occurs first. Appropriate measures, chemical, biological or mechanical, would be followed to prevent the spread of weed infestations and to reduce potential for spreading weed seed via equipment use.

Upon completion of all production operations, final reclamation of LOP disturbance would be initiated. Reclamation operations would generally include: (1) complete cleanup of the disturbed areas (drill sites, access roads, etc.); (2) restoration of the disturbed areas to the approximate ground contour that existed prior to construction; (3) ripping of compacted areas; (4) replacement of topsoil over all disturbed areas; (5) seeding of reclaimed areas with a certified weed-free seed mixture agreed upon with the surface owner; and (6) fertilizing, if considered necessary. Reclamation measures for each disturbed area would be derived from consultation with the surface owner, and would be specific to each site and the conditions at that site. Interim and final reclamation would occur during the first seasonal opportunity (i.e., after October 15 until the soil is frozen, and before May 15). Reclamation activities would not be conducted using frozen soil material. Spring seeding would be conducted only if fall seeding is not feasible.

Power Sources

The Operators anticipate the need for external power sources to support the BNGPA. These power sources include the use of solar, wind, natural-gas engines, and electrical lines. If and when additional power lines are needed for electricity necessary to produce the natural gas, the respective Operator would make a site-specific proposal. The proposal would address site-specific issues including, but not limited to topography, land-owner and regulatory desires, and cultural and wildlife resources. The Operator would employ BMPs to minimize impacts associated with the proposal.

Electronic Measurement

The Operators propose installing remote electronic measurement at new well locations in the BNGPA where economic and technical conditions warrant the use of such equipment. Electronic measurement allows the Operator's field personnel to remotely monitor the gas production from each well for temperature, pressure, and well flow. Therefore, the remote electronic measurement reduces field trips by the Operator's field personnel. The remote electronic measurement would be powered by a solar panel/battery recharge system.

Produced Water

Each producing well site would have a produced-water evaporation pit constructed. Approximately 70 percent of the new locations would have a 40 foot x 40 foot evaporation pit, and 30 percent of the locations would have a 60 foot x 60 foot evaporation pit. All pits would be about 5 feet in depth. 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. One operator trucks excess water to a 182,000 bbl facility located in the NW¼SW¼ of Section 7 T36N, R31E in Phillips County, while another makes approximately two trips per day to a 32,000 bbl central water pit located in the SE¼NE¼ of Section 7, T32N, R33E in Phillips County, Montana. Accumulated solids (if any) would be transported to an approved disposal site. Other Operators have, or may also construct, similar permitted, centralized produced-water disposal facilities.

Artificial Lift

The Operators would install artificial lift (AL) systems at new and existing well locations where required by reservoir and wellbore conditions. Artificial lift is utilized to remove formation water from the wellbore to enhance gas production, and ultimate gas recovery, while minimizing additional impact on the field's environment. If AL is not utilized, ultimately available natural gas will decrease and certain wells will be prematurely abandoned. Examples of AL include, but are not limited to, progressive cavity (PC) pumps or reciprocating rod pumps or pumpjacks (PJ). Pumpjacks and PC pumps are currently being used in the BNGPA.

Anticipated location of installations

In most natural gas reservoirs, particularly 'high-quality' reservoirs such as Gulf Coast sandstones, the structural position of the wells is the primary controlling factor with respect to water production. Wells located lower on the structure (down-dip) are generally the first to produce water and require AL for continued gas production. While structural position is undoubtedly one of the factors in controlling water production in the BNGPA, the nature of the reservoirs makes the issue more complex. Unlike high-quality reservoirs, wells in the BNGPA located higher on the structure can yield higher water production than wells located lower on the structure. At least one causative factor is the productive reservoirs in the BNGPA, which are generally considered to be 'shaley sands.' The reservoirs contain high percentages of clays (generally illite / smectite and illite / mica mixes) that reduce both effective porosity and permeability. Further, these clays allow the reservoir rocks to hold more water than would otherwise be possible.

While understanding what controls water production in the BNGPA from a geologic standpoint is difficult, the petroleum engineering aspects of the problem are fairly straightforward: As gas production naturally declines over time through reservoir depletion, the 'critical velocity' needed to lift water from the wellbore is no longer attainable. Hence, water builds up in the wellbore and either inhibits gas production or causes the well to quit producing altogether. This problem is commonly known as 'liquid loading.' Artificial lift is a means of mechanically removing the water from the wellbore to alleviate this problem.

Until recently, operators in the BNGPA had very little need for AL. However, two operators have now installed AL on approximately 39 federal wells and numerous fee-surface wells within the BNGPA. These installations have demonstrated that AL is now necessary in portions of the BNGPA and can be successfully employed to optimize gas production and reserves.

Based on the Operators' current and anticipated future needs, the following tables summarize AL installations by operator and in total.

Table 2.2-4. Artificial Lifts, All Operators

Year	Operator	Total AL (PC or PJ)	AL on Federal Surface	AL on Other Surface
1	All operators	115	72	43
2	All operators	105	63	42
3	All operators	135	72	58
Life of Field (Total AL operating at a time)	All operators	990	375	315

Table 2.2-5. Artificial Lifts, Fidelity E&P

Year	Operator	Total AL (PC or PJ)	AL on Federal Surface	AL on Other Surface
1	Fidelity E&P	10	4	6
2	Fidelity E&P	25	10	15
3	Fidelity E&P	50	20	30
Life of Field (Total AL operating at a time)	Fidelity E&P	350	150	200

Table 2.2-6. Artificial Lifts, Noble

Year	Operator	Total AL (PC or PJ)	AL on Federal Surface	AL on Other Surface
1	Noble	100	65	35
2	Noble	75	50	25
3	Noble	75	50	25
Life of Field (Total AL operating at a time)	Noble	550	165	85

Table 2.2-7. Artificial Lifts, Omimex

Year	Operator	Total AL (PC or PJ)	AL on Federal Surface	AL on Other Surface
1	Omimex	5	3	2
2	Omimex	5	3	2
3	Omimex	10	2	3
Life of Field (Total AL operating at a time)	Omimex	30	20	10

Table 2.2-8. Artificial Lifts, Decker

Year	Operator	Total AL (PC or PJ)	AL on Federal Surface	AL on Other Surface
1	Decker	14	12	2
2	Decker	14	12	2
3	Decker	14	12	2
Life of Field (Total AL operating at a time)	Decker	60	40	20

Assumptions:
1. Company continues to install siphon strings as opposed to AL.
2. Company converts selected wells to siphon strings.
3. Average 10 new wells per year for 30 years = 300 wells.
4. Average 20% of total wells will be AL = 60 wells.

The two options for AL equipment, progressive cavity (PC) and pumpjack (PJ), are discussed below.

Option 1: Progressive Cavity Pump (PC pump) – Installation and Use

Production site requirements

The use of a PC pump would not expand the footprint of the existing well site. The PC pump would be located within the well site location, with the footprint being approximately 3.5 x 16 feet. The PC pump would be installed on the well head inside the existing well house. If powered by a generator, the generator would sit outside the well house within the well site footprint. The generator would be approximately 28 x 58 inches and 34 inches high.

Installation requirements

A truck-mounted rig would be needed to modify the well and install the required tubing and rods (this would also likely be needed for other AL methods, since the production tubing is too small in diameter for any AL method).

Operational requirements

PC pumps would be powered by an electric motor or a natural gas-fired generator. Because of the small amount of available electrical power, approximately 80 percent of AL applications would have a generator as a power source. In areas where electrical power is within a close radius of a proposed location, electrical power could be considered, either above or below ground when needed.

The typical generator used on PC pumps has a 4-stroke, lean-burn, natural gas-fired engine ranging from 8.8 to 26.2 horsepower (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 revolutions per minute (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 1,000 standard cubic feet per day (mscfd).

Anticipated sound levels

Generator-powered PC pumps have sound readings of 80 decibels (dBA) at 100 percent load and 63 dBA at a 50 percent load with the use of a ‘quiet package’ or increased muffling. If electrical power were utilized the noise reading would be negligible.

Water production

The use of PC pumps would increase a well’s water production (as well as natural-gas production) over the near term (preliminary data indicates that per-well water production may be up to 15 BWPD with the initiation of AL). This rate of water production would decline approximately 5–8 percent per year. The increased water production would likely exceed what could be handled by the existing evaporation pit at each location. Water-hauling by truck to a central evaporation facility (discussed under Produced Water) would likely be required.

Maintenance requirements

PC pumps can run for approximately three years before any well or tubing maintenance is required. Generators for PC pumps require an oil change every 30–60 days, which would have the same environmental impact as a typical site visit to the site by the pumper.

Visual impacts

Since the PC pump would be enclosed in a well house that is painted with the current BLM-approved color, there would be no additional visual impact. If the PC pump were powered by a generator, the generator case could be colored to minimize the visual impact; this would be unnecessary if electrical power were used.

Option 2: Pumpjack Unit – Installation and Use

The use of a pumpjack would not expand the footprint of the existing wellsite. Within the wellsite location, the pumpjack footprint would be approximately 16 x 3.5 feet. Maximum height during stroke is approximately 13.5 feet.

Installation Requirements

A truck-mounted rig would be needed to modify the well and install the required tubing and rods (this would also likely be needed for other AL methods, since the small diameter production tubing is too small for any AL method). The skid-mounted pumpjack would be placed on approximately two inches of crushed rock, which would serve as the base/foundation for the installation. There would be no permanent structure associated with the pumping unit.

Operational requirements

Pumpjacks would be powered by an electric motor or a natural gas-fired generator. Because of the small amount of available electrical power, approximately 80 percent of AL applications would have a generator as a power source. In areas where electrical power is within a close radius of a proposed location, electrical power could be considered, either above or below ground when needed.

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.

Anticipated sound levels

The engine-powered pumpjack measurements at the factory suggest that factory-installed mufflers limit the sound of the engine to approximately 86 dBA at a distance of one meter directly in front of the exhaust outlet, while the noise level was 71.2 dBA at a distance of one meter and at a 90° angle from the exhaust outlet. In certain areas within the BNGPA, an Operator has worked with BLM to install ‘hospital-grade’ (or equivalent) mufflers, and BLM reviewed these field installations. These mufflers are expected to achieve a 35–40 dBA reduction in noise levels. One reference suggests that the noise level may be approximately 40 dBA at a distance of 7–10 meters from the source (see Table 4.15-1).

Water production

The use of pumpjacks would increase a well’s water production (as well as natural-gas production) over the near term (preliminary data collected by Noble Energy indicates that per-

well water production would be up to 15 BWPD with the initiation of AL). This rate of water production would decline approximately 5–8 percent per year. The increased water production would likely exceed what can be handled by the existing evaporation pit at each location. Water-hauling by trucks to a central evaporation facility (discussed under Produced Water) would likely be required.

Maintenance requirements

Generators for pumpjack engines require an oil change every 30–60 days, which would have the same environmental impact as a typical site visit by the pumper.

Visual impacts

The pumpjacks may create a greater visual impact than other AL methods, primarily due to size. BLM and surface owners identify painting of pumpjacks and other equipment to minimize impacts. The Operators would work with BLM and the surface owners to determine methods to minimize visual impacts such as the application color schemes that blend into the landscape.

Power Sources

The Operators anticipate the need for external power sources to support the BNGPA, particularly for the use of artificial lift. These power sources include the use of solar, wind, natural gas engines, and electrical lines. If and when additional power lines are needed for electricity necessary to produce the natural gas, the respective Operator would make a site-specific proposal. The proposal would address site-specific issues including, but not limited to, topography, land-owner and regulatory desires, and cultural and wildlife resources. The Operators would attempt to employ BMPs to minimize impacts associated with the proposal.

Gas-Gathering Operations

Typical operations include the gathering of natural gas via gathering lines. These gathering lines bring the gas to strategically placed field compressors. The gas is then compressed by field compressors (Bitter Creek) and delivered to four field outlets. These outlets are Williston Basin Interstate Pipelines' (WBIP) Saco Compressor Station, Omimex's Whitewater Compressor Station, WBIP's Malta Delivery Point, and WBIP's Whitewater Delivery Point.

- The WBIP Saco Compressor Station sends gas to the east past Hinsdale, Fort Peck, Glasgow, Vida, and ends north of Glendive. Montana Dakota Utilities (MDU) has firm capacity on this line and uses the capacity to serve all the towns located along this route. From north of Glendive, MDU can route the gas to many different markets, as well as to storage.
- The Omimex Whitewater Compressor Station sends gas north to the Northern Border Pipeline, which has markets in the mid-continent areas.
- The WBIP Malta Delivery Point takes gas from a Bitter Creek field compressor station and delivers it to the Malta town border station. MDU uses this gas to serve the town of Malta.
- The WBIP Whitewater Delivery Point takes gas from a Bitter Creek gathering line and delivers it to the Whitewater town border station. MDU uses this gas to serve the town of Whitewater.

Following is the current breakdown of produced gas destinations as of March 2006:

- WBIP Saco.....52%
- Omimex Whitewater 46%
- WBIP Malta Delivery.....2%
- WBIP Whitewater Delivery .....<1%

This breakdown does not take into consideration the in-field usage for compressor fuel, catalytic heaters, meter-shed stoves, farm taps, or similar uses.

Gas Compression

The Operators are proposing the addition of four new compressor stations. Three of the four stations would be 300 feet x 300 feet in size while the fourth would be 500 feet x 500 feet. Total surface disturbance for the compressor stations would be approximately 12.0 acres. Each site would have one new compressor. Two of the four stations would be powered by 600-hp compressors (Ajax DPC-2803LE units) and the other two would be powered by 400-hp compressors (Ajax DPC 2802LE units). In addition, the Operators are proposing to add two 400-hp compressors to existing compressor stations (East Saco and West Saco). Table 2.2-9 shows proposed compression for the BNGPA. Additional compression may be proposed as field conditions warrant and may be subject to additional NEPA analysis.

Table 2.2-9. Proposed Gas Compression

Station	Station Unit #	Description	HP	Field	GEOGRAPHICAL LOCATION			
					County	Section	Twp	Range
N Saco	#1	Ajax DPC-2803LE	600	Bowdoin East	Phillips	6	32N	34E
SE Nelson	#1	Ajax DPC-2803LE	600	Bowdoin East	Phillips	31	32N	33E
Cole	#1	Ajax DPC-2802LE	400	Bowdoin East	Phillips	7	32N	33E
System H	#1	Ajax DPC-2802LE	400	Bowdoin West	Phillips	33	37N	30E
East Saco	#2	Ajax or Screw	400	Bowdoin East	Valley	25	32N	34E
West Saco	#2	Ajax or Screw	400	Bowdoin East	Phillips	26	32N	33E
Total proposed hp			2,800					

2.2.5 Applicant-Committed Measures

Following are mitigation measures and agency-required procedures on public lands to avoid or mitigate resource or other public land-use impacts. These measures would be applied on privately owned surface and State of Montana lands only if the oil and gas estate is federally administered or unless otherwise specified by the involved private and/or the State surface owners**.** An exception to a mitigation measure and/or design feature may be approved on public land on a case-by-case basis when deemed appropriate by the BLM. An exception would be approved only after a thorough, site-specific analysis determined that the resource or land use for which the measure was put in place is not present or would not be significantly impacted.

2.2.5.1 Preconstruction Planning and Design Measures

The Operators and the BLM would make on-site interdisciplinary inspections of each proposed and staked facility site (e.g., well sites), new access road, and pipeline alignment project so that

site-specific recommendations and mitigation measures can be developed.

- New road construction and maintenance of existing roads in the BNGPA would be accomplished in accordance with BLM Manual 9113 standards unless private land-owners or the State of Montana specify otherwise.
- The Operators would prepare and submit an APD for each drill site on federal leases to the BLM for approval prior to initiation of construction. Also prior to construction, the Operators or their contractors would submit a Sundry Notice and/or right-of-way application for each pipeline and access road segment on federal leases. The APD would include a Surface Use Plan that would show the layout of the drill pad over the existing topography, dimensions of the pad, volumes and cross-sections of cut-and-fill, location and dimensions of reserve pit, and access-road egress and ingress. The APD, Sundry Notice, and/or right-of-way application plan would also itemize project administration, time frame, and responsible parties. In addition, a reclamation plan would be developed by the Operators for each facility in consultation with the BLM.
- The Operators would slope-stake construction activities when required by the BLM (e.g., steep and/or unstable slopes) and receive approval from the BLM prior to the start of construction.

2.2.5.2 Resource-Specific Requirements

The Operators propose to implement the following resource-specific mitigation measures and agency requirements.

Geology/Minerals/Paleontology

Mitigation measures presented in the Soils and Water Resources sections would avoid or minimize many of the potential impacts to the surface mineral resources. Protection of subsurface mineral resources from adverse impacts would be provided by the BLM casing and cementing policy.

Paleontological resource values would be protected through the following mitigation measure:

- If recommended by the BLM, survey each proposed facility located in areas with known and potential vertebrate paleontological resource significance (Class II) using a BLM-approved paleontologist prior to surface disturbance (BLM 1987*b*; 1990*a*). If paleontological resources are discovered at any time during construction, halt all construction activities and immediately notify BLM personnel. Work would not proceed until paleontological materials are properly evaluated by a qualified paleontologist.

Climate and Air Quality

- Prohibit burning of garbage or refuse at the drill sites or other facilities.
- When an air quality, soil loss, or safety problem is identified as a result of fugitive dust, initiate immediate abatement. The BLM would approve the procedure (e.g., application of water and magnesium chloride) for dust abatement at facility construction sites as well as locations for use and application rates. Water, if approved for this purpose, must be obtained by the Operator from State-approved source(s).

Soils

- Reduce the area of disturbance to the absolute minimum necessary for construction and production operations while providing for the safety of personnel (see Table 2.3-1, page 2-

39, Soils, Approximate Area of Disturbance). The Operators would restrict off-road vehicle activity.

- Where feasible, locate buried pipelines immediately adjacent to roads to avoid creating separate areas of disturbance and in order to reduce the total area of disturbance.
- Avoid using frozen or saturated soils as construction material.
- Minimize construction activities in areas with soils that have a severe erosion hazard, and apply special slope-stabilizing structures if construction cannot be avoided in these areas.
- Avoid development on areas where erosion cannot be effectively controlled/mitigated and reclamation to BLM standards is likely to be unsuccessful.
- Design cutslopes in a manner that would allow retention of topsoil, application of surface treatments, such as mulch, and subsequent revegetation.
- Selectively strip and salvage topsoil from all disturbed areas to an average depth of four to six inches at each location.
- Where possible, minimize disturbance to vegetated cut-and-fill areas on existing improved roads.
- Install runoff and erosion control measures such as water bars, berms, and silt fences if needed, as prescribed in **Appendix D—Reclamation Plan**.
- Inspect all runoff and erosion-control structures on a regular schedule, and after major runoff events. During inspection, clean and maintain the control structures in functional condition. Conduct inspection and maintenance on schedule for the duration of construction, drilling, production, and final reclamation until successful revegetation and soil stability is attained.
- Complete interim reclamation to minimize the footprint of disturbance on all areas where final reclamation procedures cannot be promptly implemented. Interim reclamation measures include recontouring, spreading topsoil, and seeding and/or implementing erosion- and weed-control measures.
- Implement final reclamation measures when all disturbance and use of an area are finished. Final reclamation will serve to return the area to the approximate pre-disturbance condition and set the course for eventual ecosystem restoration. Final reclamation procedures may include recontouring, respreading topsoil, ripping, erosion and weed control, seeding, and grazing deferment.
- Conduct monitoring and maintenance of final reclamation, to include observing and measuring the success of final reclamation efforts, and determine if further reclamation efforts are needed.
- To prevent or minimize impacts caused by vehicle travel on wet roads, allow vehicle traffic on BNGPA roads only during dry or frozen conditions. Alternatively, improve roads in areas with high traffic-use patterns.

Water Resources

- Limit construction of drainage crossings to no-flow periods or low-flow periods.
- Minimize the area of disturbance within ephemeral and intermittent drainage channel environments.

- Prohibit construction of well sites, access roads, and pipelines within 500 feet of surface water and/or riparian areas. Exceptions would be granted by the BLM based on an environmental analysis and site-specific mitigation plans.
- Implement minor routing variations during access road layout to avoid steep slopes adjacent to ephemeral or intermittent drainage channels. Maintain a 100-foot-wide buffer strip of natural vegetation where possible (not including wetland vegetation) between all construction activities and ephemeral and intermittent drainage channels.
- Do not install culverts on ephemeral drainages. The use of culverts on intermittent drainage crossings would be analyzed on a case-by-case basis. Design all drainage-crossing structures to carry 25- to 50-year discharge events, or as otherwise directed by the BLM.
- Design channel crossings to minimize changes in channel geometry and subsequent changes in flow hydraulics.
- Maintain vegetation barriers occurring between construction activities and ephemeral and intermittent channels.
- Minimize construction activities in areas of steep slopes and install special slope-stabilizing structures if construction cannot be avoided in these areas.
- Install runoff- and erosion-control measures such as water bars, berms, and interceptor ditches as needed.
- Include adequate drainage-control devices and measures in the road design (e.g., road berms and drainage ditches, diversion ditches, cross drains, culverts, out-sloping, and energy dissipators) at sufficient intervals and intensities to adequately control and direct surface runoff above, below, and within the road environment, in order to avoid erosion-concentrated flows. Use erosion-control devices in conjunction with the surface runoff and drainage-control devices and measures such as temporary barriers, ditch blocks, erosion stops, mattes, mulches, and vegetative covers. Implement a revegetation program as soon as possible to re-establish the soil protection afforded by a vegetal cover.
- Design and construct interception ditches, sediment traps, water bars, and revegetation and soil stabilization measures if needed.
- Construct channel crossings for buried pipelines such that the pipe is buried a minimum of four feet below the channel bottom.
- Regrade disturbed channel beds to the original geometric configuration with the same or very similar bed material.
- Upon completion of construction activities, restore topography to near pre-existing contours at well sites and other facility sites, and along access roads and pipelines. Replace up to 12 inches of topsoil or suitable plant-growth material over all disturbed surfaces. Apply fertilizer, seed (specified in a reclamation plan), and mulch as required.
- Ensure that the project complies with EO 11990 (floodplains protection) and RMP management directives that relate to protection of water resources identified in Section 4.4.2 These regulations require avoidance of stream channels to the maximum practicable extent. Where total avoidance is not practicable, implement measures to minimize impacts to streams and associated floodplains/floodways. Where streams and floodplains cannot be avoided, the Operators would be required to show the BLM AO why such resources cannot be totally avoided and how impacts would be minimized during the APD process.

- Case wells during drilling, and case and cement all wells in accordance with Onshore Order No. 2 to protect accessible high-quality aquifers. High-quality aquifers are those with known water quality of 10,000 ppm TDS or less. The protection of high-quality aquifers involves well casing and welding of sufficient integrity to contain all fluids under high pressure during drilling and well completion. Further, ensure that wells adhere to the appropriate BLM cementing policy.
- Construct reserve pits so that a minimum of one-half of the total depth is below the original ground surface on the lowest point within the pit. To prevent seepage of fluids, utilize drilling mud gel or poly liners to line reserve pits in areas where subsurface material would not contain fluids. Liners would be of sufficient strength and thickness to withstand normal installation and use. The liner would be impermeable (i.e., having a permeability of less than 10^{-7} cm/sec) and chemically compatible with all substances which may be put in the pit.
- Maintain two feet of freeboard on all reserve pits to ensure the reserve pits are not in danger of overflowing. Shut down drilling operations until the problem is corrected if leakage is found outside the pit.
- Extract hydrostatic test water used in conjunction with pipeline testing and all water used during construction activities from sources with sufficient quantities and through appropriation permits approved by the State of Montana.
- Discharge all concentrated water flows within access road rights-of-way onto or through an energy dissipater structure (e.g., rip-rapped aprons and discharge points) and discharge into undisturbed vegetation.
- Develop and implement a storm-water pollution plan for storm-water runoff at drill sites as required per MDEQ storm water MPDES permit requirements.
- Coordinate with the COE to determine the specific Clean Water Act (CWA) Section 404 Permit requirements and conditions (including the potential requirement of compensatory mitigation) for each facility that occurs in Waters of the U.S. to prevent the occurrence of significant impact to such waters.
- Ensure that the project must comply with all applicable requirements of the CWA, including the requirement to obtain an MPDES permit.

Vegetation and Wetlands

- Seed and stabilize disturbed areas with mixtures and treatment guidelines prescribed in the approved APD/right-of-way.
- Evaluate all project facility sites for occurrence and distribution of waters of the U.S., special aquatic sites, and jurisdictional wetlands. Locate all project facilities out of these sensitive areas. If complete avoidance is not possible, minimize impacts through modification and minor relocations. Coordinate activities that involve dredge or fill into wetlands with the COE.
- Conduct site-specific surveys for federally listed threatened and endangered, candidate, and proposed plant species, and plant species of special concern prior to any surface disturbance in areas determined by the BLM to contain potential habitat for such species. If such plant species or their habitat are found during the surveys, minor adjustments to the location of project facilities would be made to avoid the plant species and/or their habitat. Copies of these surveys would be provided to the BLM.

Range Resources and Other Land Uses

- Coordinate with the affected livestock operators to ensure that livestock control structures remain functional during drilling and production operations.

Wildlife

- Unless an exception is granted by the BLM, prevent disturbance in habitats designated as big game winter range between December 1 and May 15.
- Within big game winter ranges, locate disturbances so that specific important vegetation types, as identified by the BLM, would be avoided where possible.
- During reclamation, establish a variety of forage species that are useful to resident herbivores by specifying the seed mixes in the approved APD/right-of-way.
- Prohibit surface disturbance within 1/4 mile of Greater sage-grouse leks unless they are considered historic (have not been used in the past 7–10 years).
- Prohibit surface disturbance within two miles of an active or known Greater sage-grouse lek between March 1 and June 30, unless excepted.
- Prohibit surface disturbance within identified patches of Greater sage-grouse severe winter habitat.
- Manage produced water to reduce the spread of West Nile virus within sage-grouse habitat areas. Implement the following impoundment construction techniques and measures to eliminate water sources that support breeding mosquitoes:
    - Overbuild the size of ponds to accommodate a greater volume of water than is discharged. This will result in non-vegetated and muddy shorelines that breeding mosquitoes avoid.
    - Build steep shorelines to reduce shallow water and aquatic vegetation around the perimeter of impoundments. Construction of steep shorelines also will increase wave action that deters mosquito production.
    - Maintain the water level below rooted vegetation for a muddy shoreline that is unfavorable habitat for mosquito larvae. Rooted vegetation includes both aquatic and upland vegetative types. Always avoid flooding terrestrial vegetation in flat terrain or low-lying areas.
    - Use a horizontal pipe to discharge inflow directly into existing open water, thus precluding shallow surface inflow and accumulation of sediment that promotes aquatic vegetation.
    - Fence pond site to restrict access by livestock and other wild ungulates that trample and disturb shorelines, enrich sediments with manure, and create hoof-print pockets of water that are attractive to breeding mosquitoes.
    - Use adulticides to target adult mosquito populations and larvicides to control the hatching of mosquito larvae, using approved pesticides and utilizing licensed applicators with a Pesticide Use Plan.
- Prohibit disturbance during the critical nesting season (March 1–August 31, depending on species) within one mile of an active nest of listed or sensitive raptor species, and 3/4–1/2 mile (depending upon species or line of sight) of an active nest of other raptor species. The

nature of the restrictions and the protection radius would vary according to the raptor species involved and would be determined by the BLM.

- In the event of a 'taking' of a raptor nest, acquire all appropriate permits.
- Prohibit disturbance of potential mountain plover nesting habitat in a given year from April 1–July 31 unless surveys are conducted to determine mountain plover presence/absence. Survey protocol would follow current BLM and FWS standards. If surveys of an area are conducted for three consecutive years and no mountain plovers are observed, the area may be cleared.
- Locate surface disturbance 50m or more from the edge of black-tailed prairie-dog colonies, where feasible.
- Conduct surveys for black-footed ferrets if a portion of a black-tailed prairie-dog colony that provides suitable black-footed ferret habitat is to be disturbed.
- Prohibit unnecessary off-site activities of operational personnel in the vicinity of the drill sites.
- Inform all project employees of applicable wildlife laws and penalties associated with unlawful take and harassment.
- Require that regular drivers undergo training to avoid vehicular collisions and the means that can be employed to minimize them.
- Implement reduced speed limits to reduce potential for vehicle/wildlife collisions.
- To protect migratory birds and wildlife in general, fence and net all reserve pits and other pits and areas that potentially contain hydrocarbon materials in accordance with BLM requirements.

Recreation

- Minimize conflicts between project vehicles/equipment and recreation traffic by posting appropriate warning signs, implementing operator safety training, and requiring project vehicles to adhere to low speed limits.
- Incorporate appropriate environmental BMPs into APDs and associated rights-of-way to mitigate anticipated impacts to surface resources in and near the developed recreation sites and the cabin sites around Nelson Reservoir in accordance with BLM Instruction Memorandum No. 2007-021 and BOR regulations.

Visual Resources

- Incorporate appropriate environmental BMPs into APDs and associated rights-of-way to mitigate anticipated impacts to surface resources on VRM Class II lands (approximately 31,535 acres) and VRM Class III lands (approximately 94,437 acres) (BLM 1994a; BLM 1994*b*) in accordance with BLM Instruction Memorandum No. 2007-021.

Cultural Resources

- If a site is determined eligible, or is listed on the National Register of Historic Places (NRHP), avoidance is the preferred alternative.
- If avoidance is not feasible, employ the plan developed by the BLM to mitigate the adverse effects associated with development.

- If cultural resources are discovered at any time during construction, cease all construction activities and immediately notify BLM personnel. Work shall not resume until a Notice to Proceed is issued by the BLM.

Socioeconomics

- Implement hiring policies that would encourage the use of local or regional workers who would not have to relocate to the area.
- Coordinate project activities with ranching and farming operations to minimize conflicts involving livestock movement and other farm and ranch operations. This would include scheduling project activities to minimize potential disturbance of large-scale livestock movements. Establish effective and frequent communication with affected ranchers and farmers to monitor and correct problems and coordinate scheduling.

Transportation and Access

Develop and maintain all roads in accordance with the Transportation Plan and Surface Operations Section of the Master APD for Phillips County and all fields/units/leases (federal) west of Hinsdale in Valley County (BLM undated). In addition:

- Use existing roads whenever possible.
- Block, reclaim, and revegetate roads on public lands that are not required for routine operation and maintenance of producing wells and ancillary facilities. Roads on private lands would be treated similarly depending on the desires of the land-owner.
- 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.
- Where possible, avoid areas with important resource values, steep slopes, and soils with a severe erosion hazard and low reclamation potential in planning for new roads.
- Employ preventive and corrective maintenance of non-county roads in the project area throughout the duration of the project. This may include blading, cleaning ditches and drainage facilities, dust abatement, noxious weed control, or other requirements as directed by the BLM or other land-owners.
- If desired by the BLM and Phillips and Valley counties, engage in a coordinated planning process for the development and maintenance of roads within the BNGPA.

Health and Safety

- Recycle drilling mud, to the extent feasible.
- Continue the practice of providing drilling mud to private land-owners for use as stock-pond sealant.
- For exotic drilling mud operations, use closed-loop systems with above-ground steel tankage.
- Recycle completion fluids, to the extent feasible.

- Provide receptacles for management of trash and construction debris generated during construction and operations prior to transport in closed containers to a county sanitarian-approved landfill for disposal.
- Provide toilet facilities for field operations.
- Recycle used oil and methanol, to the extent feasible.
- Investigate the feasibility of using produced water in well drilling and completion processes.
- Use lined produced-water evaporation pits at high-volume central facilities.
- To minimize undue exposure to hazardous situations, require measures that would preclude the public from entering hazardous areas and place warning signs alerting the public to truck traffic.
- Institute a Hazard Communication Program for all Operator employees and require subcontractor programs in accordance with OSHA 29 CFR 1910.1200. These programs are designed to educate and protect the employees and subcontractors with respect to any chemicals or hazardous substances that may be present in the work place. As every chemical or hazardous material is brought on location, require that a Material Safety Data Sheet accompany that material and become part of the file kept at the field office as required by 29 CFR 1910.1200. Ensure that all employees receive the proper training in storage, handling, and disposal of hazardous substances.
- Inventory and report chemical and hazardous materials in accordance with the Superfund Amendments and Reauthorization Act (SARA) Title III 40 CFR Part 335, if quantities exceeding 10,000 pounds or the threshold planning quantity (TPQ) are to be produced or stored in association with the Proposed Action. Submit the appropriate Section 311 and 312 forms at the required times to the state and county emergency management coordinators and the local fire departments.
- Transport and/or dispose of any hazardous wastes, as defined by the Resource Conservation and Recovery Act (RCRA), in accordance with all applicable federal, state, and local regulations.
- The Operators plan to design operations to severely limit or eliminate the need for extremely hazardous substances. The Operators also plan to avoid the creation of hazardous wastes as defined by RCRA wherever possible.
- **Appendix C—Hazardous Materials Management Plan**, provides a summary of the hazardous chemicals that may be found on a drilling or production site with examples of representative chemicals and associated physical and health hazards. At this time it is impossible to determine if these items would be stored in sufficient quantities to require reporting under the Superfund Amendments and Reauthorization Act, Title III, and in some cases, the items may not be on site at all. However, all items would become part of the Hazard Communications Plan where required, and employee training would be completed as required.
- Write and implement Spill Prevention Control and Counter-Measures (SPCC) Plans as appropriate in accordance with 40 CFR Part 112 to prevent discharge of oil into navigable waters of the United States.

Noise

- Muffle and maintain all motorized equipment according to manufacturers' specifications in an effort to achieve the recommended standard of 55 dBA (with an average day/night noise level of 49 dBA) for noise impacts to sensitive receptors at 1/4 mile from the source. When background noise exceeds 55 dBA, noise levels will be no greater than 5 dBA above background at 1/4 mile.
- To reduce the impact of noise generated by field traffic, install remote monitoring systems such as Supervisory Control and Data Acquisition (SCADA) or computer-assisted operations (CAOs), where feasible.

2.3 COMPARISON OF ALTERNATIVES

Table 2.3-1 compares the major components of the three alternatives. Table 2.3-2 compares the major effects identified in Section 4 from each of the alternatives.

Table 2.3-1. Bowdoin Natural Gas Project—Comparison of Alternatives

Project Component	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development Alternative
Well Drilling Activities:			
Number and land status of gas wells in the BNGPA	• 360 new and 198 existing private wells on 558 private surface locations • 40 new and 22 existing state wells on 62 locations	• 360 new and 198 existing private wells on 558 private surface locations. • 40 new and 22 existing state wells on 62 locations. • 420 new and 215 existing federal wells on 635 locations.	• 546 new and 301 existing private wells on 847 private surface locations. • 61 new and 33 existing state wells on 94 locations. • 638 new and 326 existing federal wells on 964 locations.
Drilling Actions	620 private and state gas wells would be drilled by conventional gas well-drilling rigs to depths of approximately 1,000 feet to 3,000 feet. Fresh water would be used in the drilling operations. A minimum of 150 feet of 7-inch steel surface casing would be cemented in place from ground surface with a minimum of three centralizers installed to protect any water aquifers. With a BOP in place for pressure control, the well would be drilled to approximately 400 feet deeper than the top of the Phillips/Greenhorn formation. 4.5-inch production casing would be centralized and cemented from the surface to the total depth of the well. Anticipated drilling period to last approximately 10–15 years.	1,255 private, state, and federal wells would be drilled in the same manner as described in Alternative A. Anticipated drilling period to last approximately 10–15 years.	1,905 private, state, and federal wells would be drilled in the same manner as described in Alternative A. Anticipated drilling period to last approximately 10–15 years.

Project Component	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development Alternative
Disposal of wastes	The 558 proposed private wells at 558 locations and 62 state wells at 62 locations would have a 60'L x 12'W x 4' or 6'D reserve pit for the disposal of drill cuttings, water, drilling mud and excess cement. The reserve pits would be fenced on three sides and the fourth would be fenced after the drilling rig has moved off of the location. BLM requires reserve pit fluids to be removed immediately upon well completion. Recycling reserve pit fluids within the field is standard practice. Upon removal or evaporation of fluids, pit closure occurs with the backfill of soil and its compaction to prevent settling. This would occur within one year after the drilling and completion of the well. Wastes would be contained on-site and disposed of at the Saco landfill. Chemical 'porta-potties' would be used during active construction, and at drilling site locations.	1,255 proposed private, state, and federal wells at 1,255 locations would be managed in the same manner as described in Alternative A.	1,905 proposed private, state, and federal wells at 1,905 locations would be managed in the same manner as described in Alternative A.
Production Support Facilities:			
Field Compressor Stations	• 16 existing stations: Bitter Creek Pipelines (15 stations), Omimex Canada (1 station). • 4 proposed stations, all Bitter Creek Pipelines. Approximate surface disturbance would be 12.0 acres.	• 16 existing stations: Bitter Creek Pipelines (15 stations), Omimex Canada (1 station). • 4 proposed stations, all Bitter Creek Pipelines. Approximate surface disturbance would be 12.0 acres.	• 16 existing stations: Bitter Creek Pipelines (15 stations), Omimex Canada (1 station). • 4 proposed stations, all Bitter Creek Pipelines. Approximate surface disturbance would be 12.0 acres.

Project Component	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development Alternative
Gas Pipelines & Electrical Lines	Approximately 104 miles plowed for private and state, 5.1-foot-wide corridor and 104 miles ditched for private and state, 25-foot-wide corridor. Total surface disturbance would be 378 acres, all short-term. Buried plastic and steel flowline to carry gas from each well of the 400 proposed and 220 existing wells to the compressor stations. Multiple flowlines would be placed in the same trench. Trenches would parallel roads to extent feasible.	Approximately 210 miles plowed for federal, private, and state, 5.1-foot-wide corridor and 210 miles ditched for federal, private, and state, 25-foot-wide corridor. Total surface disturbance would be 761.7 acres, all short-term. Buried plastic and steel flowline to carry gas from each well of the 820 proposed and 435 existing wells to the compressor stations. Multiple flowlines would be placed in same trench. Trenches would parallel roads to extent feasible. A BLM-issued right-of-way would be required for any 'off-lease' and/or third-party facilities on federal surface.	Approximately 318 miles plowed for federal, private, and state, 5.1-foot-wide corridor and 318 miles ditched for federal, private, and state, 25 feet wide corridor. Total surface disturbance would be 1,156 acres, all short-term. Buried plastic and steel flowline to carry gas from each well of the 1,245 proposed and 660 existing wells to the compressor stations. Multiple flowlines would be placed in same trench. Trenches would parallel roads to extent feasible. A BLM-issued right-of-way would be required for any 'off-lease' and/or third-party facilities on federal surface.
Road maintenance and use	• Access would primarily use roughly 207.5 miles of existing and proposed two-track roads. • Earthen materials would come from adjacent locations owned by the land-owner. • Estimated use of access would be 6 vehicles per day per well during the drilling and completion period.	Access would primarily use roughly 420 miles of existing and proposed two-track roads. Materials and road use would be the same as Alternative A.	Access would primarily use roughly 636 miles of existing and proposed two-track roads. Materials and road use would be the same as Alternative A.

Project Component	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development Alternative
Produced Water Management:			
Produced-water evaporation and/or disposal	Each producing well site (400 new and 220 existing private and state) would have a produced-water evaporation pit constructed. Approximately 60% of the new locations would have a 40' x 40' evaporation pit, 30% of the locations would have a 60' x 60' evaporation pit and 10% of the locations would have a 100' x 100' evaporation pit. All pits would be about 5 feet in depth. Approximately 25% of the evaporation pits may require periodic water hauling because of fluctuations in water production. In these cases, the water would be hauled approximately two (2) trips per week to a permitted, central water evaporation pit. All pits would be permitted as required in BLM Operating Order 7 or by MBOGC.	Same as Alternative A for 820 new and 435 existing federal, state, and private wells.	Same as Alternative A for 1,245 new and 660 existing federal, state, and private wells.
Reclamation:			
Reclamation Measures	The surface would be reclaimed in accordance with the agreements with land-owners. Disturbed areas would be seeded with a certified weed-free seed mix agreed to by the NRCS and the surface owner.	The surface would be reclaimed in accordance with the agreements with land-owners. Disturbed areas would be seeded with a certified weed-free seed mix agreed to by the BLM, NRCS and the surface owner.	The surface would be reclaimed in accordance with the agreements with land-owners. Disturbed areas would be seeded with a certified weed-free seed mix agreed to by the BLM, NRCS and the surface owner.
Reclamation Timeframes	Reclamation would take place within 1 year where specific surface-disturbing activities have been completed, and concurrent with other operations in the project area.	Same as Alternative A.	Same as Alternative A.
Monitoring Plans:			
Air Quality	Per MDEQ requirements for testing to demonstrate compliance with emission limits and Annual Emission Inventories.	Same as Alternative A.	Same as Alternative A.

Project Component	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development Alternative
Wildlife	None required.	Monitoring of specific wildlife species is required: • Big game winter range • Raptor nest success and productivity • Bald eagle winter roosts • Greater sage-grouse and sharp-tailed grouse activity • Migratory bird breeding activity • Colonial bird breeding activity • Pre- and post-development monitoring of wetland, grassland, and sagebrush habitats	Monitoring of specific wildlife species is required: • Big game winter range • Raptor nest success and productivity • Bald eagle winter roosts • Greater sage-grouse and sharp-tailed grouse activity • Migratory bird breeding activity • Colonial bird breeding activity • Pre- and post-development monitoring of wetland, grassland, and sagebrush habitats
Soils	Sites would be monitored during various stages of development and reclamation to ensure erosion is limited and soil productivity is returned.	Same as Alternative A.	Same as Alternative A.
Water Quality	Per MDEQ MPDES requirements.	Same as Alternative A.	Same as Alternative A.

Table 2.3-2. Bowdoin Natural Gas Project—Summary Comparison of Effects

Affected Resource & Effect Indicators	Existing Resource Conditions	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development
Air Quality:				
Pollutant Concentrations	The area of the proposed project is currently classified as attainment/ unclassified for NAAQS and therefore considered to be in compliance with ambient air quality standards. Existing criteria pollutant concentrations comply with MAAQS and NAAQS.	Impacts would be less than Alternative B. Project would be in compliance with all MAAQS and NAAQS. Pollutant concentrations would be below PSD increments.	Project would be in compliance with all MAAQS and NAAQS. Pollutant concentrations would be below PSD increments. Emissions information and a detailed ambient analysis can be found in Section 4.1.2.	Same as Alternative B except construction emissions, and therefore impacts, are expected to be slightly higher due to the larger number of wells being developed. Project would be in compliance with all MAAQS and NAAQS. Pollutant concentrations would be below PSD increments.

Affected Resource & Effect Indicators	Existing Resource Conditions	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development
Visibility	Continuous visibility-related optical background data were collected at the MDEQ-ARMB Class I Fort Peck Indian Reservation and the PSD Class I U.L. Bend Wilderness Area, as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. Visibility for the region is considered very good, with an average SVR of over 150 km (Malm, 2000).	Impacts would be less than Alternative B.	Project would not contribute significantly to visibility degradation at the federal PSD Class I UL Bend Wilderness Area, and MDEQ-ARMB Class I Fort Peck Indian Reservation.	Similar to Alternative B.
Atmospheric Deposition	Atmospheric deposition monitoring at the Theodore Roosevelt National Park CASTNET site show consistent trends from 1999 to 2004 with no overall increase in total deposition over that period.	Impacts would be less than Alternative B	Project would not contribute significantly to total atmospheric deposition at the federal PSD Class I UL Bend Wilderness Area, and MDEQ-ARMB Class I Fort Peck Indian Reservation.	Similar to Alternative B.
Cultural Resources:				
National Register listed or eligible sites	One site is currently listed and 45 sites are eligible, out of 1,420 sites surveyed in the BNGPA. Two NHRP-eligible sites are within an ACEC and protected from development.	This Alternative will not affect cultural resources on federal surface or split estate lands (private surface/federal minerals).	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.	Same as Alternative B.

Affected Resource & Effect Indicators	Existing Resource Conditions	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development
Areas of traditional cultural value	The Larb Hills is an important plant-gathering location for the Fort Peck tribe	Sites and areas of Traditional Native American concern would continue to be vulnerable to impacts from development on private lands	Developments will provide increased access to kinnikinnick and other ceremonial/medicinal plants. At the same time, these ground disturbances will potentially destroy important gathering locations. The BLM will work with the tribes to minimize impacts to areas with high concentrations of important traditional plants.	Same as Alternative B.
Geology and Minerals:				
Natural Gas Develop-ment	The natural gas resources of the Bowdoin Dome have been known since before World War I. Production on this structure is chiefly from relatively shallow (< 3,000-foot) reservoirs in the Upper Cretaceous Carlile Shale, Mowry/Greenhorn Formations, and Belle Fourche Shale, and is from a combination of stratigraphic and structural traps.	This alternative will allow for development of gas reserves under state and private lands, but since no wells will be drilled on federal lands, no federal reserves or revenues will be produced.	Natural gas reserves developed under federal, state and private lands will eventually be depleted. Recovery of gas reserves would generate federal, state and private revenues.	Same as Alternative B.

Affected Resource & Effect Indicators	Existing Resource Conditions	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development
Hydrology: Surface Water Resources				
Increased turbidity, salinity and sedimentation of surface waters due to runoff from disturbed areas (e.g., roads).	Water quality constituents of concern for the BNGPA include total suspended solids, salinity, total dissolved solids, nutrient enrichment, and some trace metals. Erosive and saline soils occur within the BNGPA.	Minimal effects, with the proper use of construction techniques, drilling practices, proper operating procedures, use of evaporation ponds, successful reclamation, and the adherence to applicable federal (CWA Section 404 & 401), state (MBOGC, MDEQ), and local water quality (Conservation District) laws/guidelines and regulations. MBOGC would be the primary permitting agency on the state and private wells under this Alternative.	Minimal effects. Same as Alternative A, but with the BLM as the permitting agency on all federal wells/resources, and all federal well construction activities adhering to the BLM Gold Book Standards. Additionally, applicant-committed mitigations may further reduce effects to water resources.	Minimal effects. Same as Alternative B.
Contamination of surface waters from accidental spills or leaks of hydrocarbons.	No hydrocarbon contamination of surface waters currently present within the BNGPA.	Minimal effects with proper construction techniques, drilling practices, operating procedures, use of evapo-ration ponds, successful reclamation, and adherence to applicable federal (CWA Section 404 & 401), state (MBOGC, MTDEQ), and local water quality (Conservation District) laws/guidelines and regulations. MBOGC would be the primary permitting agency on state and private wells.	Minimal effects. Same as Alternative A, but with the BLM as the permitting agency on all federal wells/resources, and all federal well construction activities adhering to BLM Gold Book Standards. Additionally, applicant-committed measures may further reduce effects to water resources.	Minimal effects. Same as Alternative B.

Affected Resource & Effect Indicators	Existing Resource Conditions	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development
Surface water depletions.	None currently present within the BNGPA.	Insignificant. Water used for the project would be purchased from an existing commercial source.	Insignificant. Same as Alternative A.	Insignificant. Same as Alternative A.
Contamination of surface waters from discharge of unsuitable quality produced water.	None currently present within the BNGPA.	Insignificant. The relatively small amounts of produced water would be disposed of via evaporation from ponds built at well pad sites.	Insignificant. Same as Alternative A.	Insignificant. Same as Alternative A.
Hydrology: Groundwater Resources				
Contamination of groundwater from discharge of produced water, accidental spills/leaks, and/or cross aquifer mixing through wellbores.	Shallow groundwater is generally marginal for domestic use due to high TDS concentrations, but suitable for livestock and wildlife use. Deeper aquifers (> 500 ft. bgs) are generally unsuitable for domestic use due to elevated TDS levels, and are generally too deep to be economical for livestock and wildlife use. The Madison Formation, however, is suitable for domestic use.	Minimal effects, with the proper use of construction and drilling techniques, well completion, and operating procedures as permitted by MBOGC.	Minimal effects. Same as Alternative A, but with the BLM as the permitting agency on all federal wells/resources, and all federal well construction, drilling, completion and construction activities adhering to the BLM Gold Book Standards. Additionally, applicant-committed mitigations may further reduce effects to water resources.	Minimal effects. Same as Alternative B.

Affected Resource & Effect Indicators	Existing Resource Conditions	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development
Reduced groundwater availability from withdrawal of drilling water.	Shallow groundwater is generally scarce or absent within the BNGPA.	Insignificant. No drawdown of groundwater resources is anticipated, as water used for the project would be purchased from an existing commercial source.	Insignificant. Same as Alternative A.	Insignificant. Same as Alternative A.
Draining of prairie pothole wetlands from pipelines.	Prairie potholes are abundant, but standing water is present perhaps one year in five due to the semi-arid climate.	Minimal effects, with the proper use of road/pipeline construction, drilling techniques, and adherence to permit conditions as regulated by Section 404 of the Clean Water Act and other applicable state and local laws.	Minimal effects. Same as Alternative A, but with the BLM as the permitting agency on all federal wells/resources, and the use of BLM Gold Book Standards for construction. Additionally, applicant-committed mitigations may further reduce effects to water resources.	Minimal effects. Same as Alternative B.
Livestock Grazing:				
Livestock Operations	Approximately 148 cow/calf livestock operations occur within the project area (Kautt 2008).	No impacts to livestock operations.	Produced water may create opportunities for additional water sources and livestock operations may benefit. During production, 10 animal unit months would remain unavailable to livestock operations.	Similar to Alternative B. During production, 25 animal unit months would remain unavailable to livestock operations.

Affected Resource & Effect Indicators	Existing Resource Conditions	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development
Soils—Approximate area of disturbance:				
Roads (considered long-term disturbance).	318 miles or 463 acres	208 miles or 302 acres	419 miles or 609 acres	636 miles or 925 acres
Wellpads (initial disturbance will be 1 acre per pad; after drilling activities are complete, interim reclamation will reduce disturbance to 0.5 acres per pad).	1,459 wellpads at 0.5 acres in size, for a total of 730 acres.	620 well pads with initial disturbance of 620 acres; reduced to 310 acres of long-term disturbance.	1,255 well pads with initial disturbance of 1,255 acres; reduced to 628 acres of long-term disturbance.	1,905 well pads with initial disturbance of 1,905 acres; reduced to 953 acres of long-term disturbance.
Compressor stations (considered long-term disturbance).	16 compressor stations on 48 acres	4 compressor stations on 12 acres	4 compressor stations on 12 acres	4 compressor stations on 12 acres
Flowlines (considered short-term disturbance)	Assume current flowlines have been fully reclaimed.	377 acres	762 acres	1,156 acres
Social and Economic Conditions:				
Annual Wells drilled	2005: 70 2000: 122 1996–2005 average: 66	2008 - 2012: 54 2013 - 2017: 50 2018 - 2022: 20	2008 - 2012: 110 2013 - 2017: 101 2018 - 2022: 41	2008 - 2012: 166 2013 - 2017: 154 2018 - 2022: 61
Annual average # of rigs operating in the BNGPA	1 rig	1 rig for a shorter period of time than average of the preceding 10 years.	2 rigs for part of drilling season.	3 rigs for part of drilling season.
Annual BNGPA natural gas production	19.2 Bcf in 2005	Estimated at a peak of 18.2 Bcf in 2008 including 15.7 Bcf from existing wells and 2.5 BCF from wells associated with Alternative A, declining to 2.2 Bcf in 2036 2.025 Bcf associated with existing wells and 0.147 Bcf associated with Alternative A wells.	Estimated at a peak of 22.5 Bcf in 2012 including 10.5 BCF associated with existing wells and 12.5 BCF associated with Alternative B wells, declining to 2.3 Bcf in 2036 including 2.025 Bcf associated with existing wells and 0.279 Bcf associated with alternative B wells.	Estimated at a peak of 29.1 Bcf in 2013 including 9.6 Bcf associated with existing wells and 19.5 Bcf associated with Alternative B wells, declining to 2.4 Bcf in 2036 including 2.025 associated with existing wells and 0.423 Bcf associated with Alternative C wells.

Affected Resource & Effect Indicators	Existing Resource Conditions	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development
Estimated cumulative (2008–2036) BNGPA natural gas production	N/A	290.6 including 193.1 Bcf from existing wells.	380.8 Bcf, including 193.1 Bcf from existing wells.	479.4 Bcf including 193.1 Bcf from existing wells.
Estimated BNGPA-related employment: direct and secondary		2008: 182	2008: 256	2008: 319
BNGPA total personal income 2007–2035	N/A	$155 million	$182.1 million	$210 million
Estimated total Montana Gas Production Tax 2008–2036	N/A	Total: $153.7 M State: $ 71.0 M Phillips Cty: $ 74.8 M Valley Cty: $ 7.5 M	Total: $199.8 M State: $ 92.3 M Phillips Cty: $ 97.1 M Valley Cty: $ 10.3 M	Total: $250.1 M State: $115.6 M Phillips Cty: $121.6 M Valley Cty: $ 12.7 M
Estimated total incremental federal mineral royalties 2008–2036	N/A	No incremental federal mineral royalties would be associated with Alternative A.	Total: $ 62.0 M State: $ 30.7 M Phillips Cty: $ 6.9 M Valley Cty: $ 0.8 M	Total: $ 95.2 M State: $ 35.3 M Phillips Cty: $ 10.6 M Valley Cty: $ 1.23 M
Local government impacts	Comparatively high levels of county road maintenance demand associated with drilling, field development and production activities.	Reduced levels of road maintenance demand associated with lower drilling levels and fewer wells in production. Lower levels of BNGPA-related revenues to offset the costs of road maintenance.	Higher levels of road maintenance demand associated with higher levels of drilling. Higher levels of BNGPA-related revenues to fund road maintenance costs.	Substantially higher levels of road maintenance demand associated with higher levels of drilling and more wells in production. Substantially higher levels of BNGPA-related revenues to offset road maintenance costs.

Affected Resource & Effect Indicators	Existing Resource Conditions	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development
Effects on social groups	Many people in Phillips and Valley counties benefit directly and indirectly from the employment and tax revenues associated with BNGPA development and production. Two groups who sometimes experience adverse effects are ranchers, farmers, and other surface owners of split-estate lands and recreation visitors who sometimes experience natural-gas development and production-related changes in the recreation setting.	Fewer people would benefit from BNGPA-related employment as a result of lower annual drilling levels and fewer wells in production. Lower BNGPA tax revenues would result in a reduction in service levels or higher taxes for all county residents. Ranchers, farmers and other surface owners of split estate lands would be likely to experience fewer adverse effects. Fewer changes in the recreation setting for recreation visitors to the BNGPA would also occur.	More people would benefit from BNGPA-related employment. Higher BNGPA tax revenues would allow increased service levels or lower taxes for all county residents. Ranchers, farmers and other surface owners of split estate lands would be likely to experience more adverse effects. Changes in the recreation setting would be likely to occur in more areas.	More people would benefit from BNGPA-related employment. Substantially higher BNGPA tax revenues would allow increased service levels or lower taxes for all county residents. Ranchers, farmers and other surface owners of split estate lands would be more likely to experience higher levels of adverse effects. Changes in the recreation setting would be likely to occur in more areas of the BNGPA than under the other two alternatives.
Environmental Justice	In 2000, 18.3% of the population living in Phillips County and 13.5% of the population in Valley County had incomes below the poverty level. These figures compare to a state figure of 14.6%. There are no concentrations of racial minorities in the BNGPA.	No effects	No effects	No effects
Transportation and Access:				
Access	Total of 3,352 miles of highways and roads w/in the BNGPA	Estimated 207.5 miles of new and existing roads and two-tracks required	Estimated 418.75 miles of new and existing roads and two-tracks required	Estimated 636 miles of new and existing roads and two-tracks required

Affected Resource & Effect Indicators	Existing Resource Conditions	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development
Drilling, completion and gatherings system construction traffic	Recent traffic levels associated with an average of one drilling rig, one completion crew and one gathering system crew.	Similar levels of daily traffic during drilling; reductions in average annual traffic compared to recent levels as a result of fewer wells being drilled	Temporary increases in traffic during drilling season compared to recent levels resulting from higher drilling and field development levels.	Traffic increases substantially higher than other two alternatives resulting from higher drilling and field development levels.
Production traffic	1,450 wells visited on a schedule ranging from twice weekly to once every two weeks. 25 percent of wells require water hauling, requiring an average of two trips/ week to those wells.	Diminishing levels of well maintenance traffic resulting from reductions in total producing wells in the field. Early increases in produced water disposal-related trips as the 25 percent of wells requiring produced-water disposal age and produce less gas and more water and as new wells using artificial lift come online. Eventual reductions in total produced-water trips as wells requiring produced-water disposal cease production at higher rates than new wells requiring produced-water disposal, and wells using artificial lift come online.	Traffic related to well maintenance would diminish initially, then increase as total producing wells increase to 1,500 by 2022. Maintenance traffic would steadily decline thereafter. Produced-water disposal-related traffic would increase as the number of wells requiring produced-water disposal increase until these wells begin to cease production.	Well maintenance traffic would steadily increase as total wells increase to 2,084 by 2022 and steadily decline thereafter as wells cease production. Produced-water disposal-related traffic would continue to increase after 2022 as the estimated 25 percent of wells requiring produced-water disposal age and produce less gas and more water. This increase would continue until these wells begin to cease production.
Road maintenance	Gas traffic on county roads results in relatively high levels of maintenance demand.	Lower maintenance demand associated with lower drilling levels and fewer wells in production, with the exception of access roads for produced-water disposal facilities.	Higher drilling-related road maintenance demand during first 10 years of drilling. Similar higher levels of production and produced-water disposal-related demand.	Substantially higher levels of drilling, production and produced-water disposal - related road maintenance demand.
Vegetation:				

Affected Resource & Effect Indicators	Existing Resource Conditions	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development
Montana Plant Species of Concern	Chaffweed, Dwarf woolly-head, Hot spring phacelia, Long-sheath waterweed, Roundleaf water-hyssop, Scarlet ammannia, Slender-branched popcorn flower, Slender bulrush are known to occur on the project area (Taylor 2006).	No expected impacts to Montana plant species of concern from development activities. 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 is not expected to impact any wetlands; therefore, no impacts are expected to occur to these species.	Same as Alternative A.	Same as Alternative A.

Affected Resource & Effect Indicators	Existing Resource Conditions	Alternative A No Federal Action	Alternative B Proposed Action with Additional Mitigation	Alternative C Maximum Development
Proximity to T&E species habitat	There are no known FWS threatened, endangered, proposed, candidate, or experimental plant species documented on the BNGPA (Taylor 2006).	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.	Development activities 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 B are not expected even though the scope of the impacts is more widespread than Alternative A because of the increased development.	Development activities may affect some threatened, endangered, candidate or proposed species of wildlife, fish, and plants through habitat loss, alteration, and fragmentation, disturbance, displacement, and mortality. Impacts will be greater than both Alternatives A and B because more acres of disturbance will occur under Alternative C. In addition, the scope of the impacts will be more widespread than Alternative A or B due to the proposed increased development. Nevertheless, significant impacts to these species are not expected.
Wildlife:				
Habitat fragmentation and disturbance in the project area	The project area is currently fragmented by many roads, power lines, and existing oil and gas development.	Increased habitat fragmentation and disturbance from 620 wells, 206 miles of existing and proposed two-track roads.	Increased habitat fragmentation and disturbance from 1,255 wells, 420 miles of existing and proposed two-track roads.	Increased habitat fragmentation and disturbance from 1,905 wells, 636 miles of existing and proposed two-track roads.

3. AFFECTED ENVIRONMENT

3.0 INTRODUCTION

This section describes the affected environment, including the cultural, historical, social and economic conditions that could be affected by implementation of the alternatives described in Section 2. Aspects of the affected environments described in this section focus on the relevant major issues presented in Section 2. Certain critical environmental components require analysis under BLM policy. These items are presented below in Table 3.0-1.

Table 3.0-1. Critical Elements Requiring Mandatory Evaluation

Mandatory Element	Not Present	No Impact	Potentially Impacted
Threatened and Endangered Species			X
Floodplains		X	
Wilderness Values	X		
ACECs			X
Water Resources			X
Air Quality			X
Cultural or Historical Values			X
Prime or Unique Farmlands	X		
Wild & Scenic Rivers	X		
Wetland/Riparian			X
Native American Religious Concerns			X
Hazardous Wastes or Solids			X
Invasive, Non-native Species			X
Environmental Justice		X	

[1] As listed in BLM *National Environmental Policy Act Handbook H-1790-1* (BLM 1988*b*) and subsequent Executive Orders

3.1 CLIMATE AND AIR QUALITY

The BNGPA is located in north-central Montana in a semi-arid continental climate regime, having a large annual range in temperature and limited precipitation. Representative temperature and precipitation measurements for the project area were collected at the Malta 7E site, Phillips County, Montana, from 1972 to 2007, approximately two miles southwest of the project area at an elevation of 2,250 feet (WRCC 2008). Representative wind data for the project area were collected at the Glasgow International Airport, Glasgow, Montana, for the years 1998 to 2002. The Glasgow International Airport is located approximately 21 miles southeast of the BNGPA.

The annual average total precipitation at Malta is 12.7 inches, ranging from 21.4 inches (1986) to 8.4 inches (1984). Precipitation is greatest from May to September with May and June the wettest months. An average of 26 inches of snow falls during the year (annual high 45.9 inches in 1975), with December through March the snowiest months. **Table 3.1-1** shows the mean monthly temperature ranges and total precipitation amounts.

The region has cool to moderate temperatures. Average daily temperatures in degrees Fahrenheit (°F) range between 5.2 °F (low) and 29.7 °F (high) in mid-winter and between 51.7 °F (low) and 83.1 °F (high) in mid-summer. Extreme temperatures have ranged from -45 °F (1972) to 108 °F (1983). The frost-free period (at 32 °F) generally occurs from mid-May to mid-September.

Table 3.1-1. Mean Monthly Temperature Ranges and Total Precipitation Amounts for Malta, MT

Month	Average Temperature Range (°F)	Total Precipitation (inches)
January	2.1–26.0	0.36
February	7.8–33.0	0.27
March	18.8–45.2	0.56
April	30.6–60.5	0.93
May	41.0–70.4	2.23
June	49.6–78.6	2.66
July	53.9–86.0	1.73
August	51.6–84.8	1.20
September	40.8–73.6	1.17
October	29.9–60.7	0.75
November	15.9–41.4	0.49
December	5.6–30.0	0.38
ANNUAL	43.2 (mean)	12.74 (mean)

Source: (WRCC 2008)

Table 3.1-2 provides the wind direction distribution in a tabular format. From this information, it is evident that the winds originate from the east to southeast approximately 36 percent of the time. The annual mean wind speed is approximately 10.6 mph.

Table 3.1-2. Wind Direction Frequency Distribution for Glasgow, MT

Wind Direction	Percent of Occurrence	Wind Direction	Percent of Occurrence	Wind Direction	Percent of Occurrence
N	3.0	SE	6.1	W	9.6
NNE	2.7	SSE	2.9	WNW	10.8
NE	3.5	S	1.9	NW	11.6
ENE	4.5	SSW	1.4	NNW	5.6
E	14.6	SW	2.0		
ESE	15.1	WSW	4.6		

Source: Glasgow, MT International Airport meteorological data collected 1998–2002.

The frequency and strength of the winds greatly affect the dispersion and transport of air pollutants. Table 3.1-3 shows the wind speed distribution and Table 3.1-4 shows the stability class distribution. The atmospheric stability class is the measure of atmospheric turbulence, which directly affects pollutant dispersion. The stability classes are divided into six categories designated ‘A’ (unstable) through ‘F’ (very stable). The ‘D’ (neutral) stability class, which implies good atmospheric dispersion conditions, occurs approximately 53 percent of the time.

Table 3.1-3. Wind Speed Distribution

Wind Speed (miles/hour)	Percent of Occurrence
0–4.0	5.2
4.0–7.5	25.0
7.5–12.1	33.6
12.1–19.0	26.1
19.0–24.7	6.4
Greater than 24.7	3.7

Table 3.1-4. Stability Class Distribution

Stability Class	Percent of Occurrence
A (unstable)	0.5
B	4.9
C	12.0
D (neutral)	53.3
E	17.6
F (very stable)	11.8

Source: Glasgow, MT meteorological data collected 1998-2002

As indicated by these data, atmospheric dispersion conditions in the BNGPA are good (although nighttime cooling will enhance stable air, inhibiting air pollutant mixing and transport). In addition dispersion conditions will be enhanced along ridges, plateaus, and on hilltops.

The Montana Ambient Air Quality Standards (MAAQS) and National Ambient Air Quality Standards (NAAQS) are health-based criteria for the maximum acceptable concentrations of air pollutants at all locations to which the public has access. Although specific air quality monitoring has not been conducted near the project area, the overall ambient air quality in the area is good, given there is very limited industrial activity in and surrounding the project area. The Montana Department of Environmental Quality—Air Resources Management Bureau (MDEQ-ARMB) has suggested representative background values to be used for this area. These values can be found in MDEQ-ARMB guidance document "Requirement for Submitting Air Dispersion Modeling Analysis." This document contains values for carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter less than 10 microns in effective diameter (PM_{10}), and sulfur dioxide (SO_2). Background values for Ozone (O_3) were taken from the CASTNET site located in Glacier National Park for the year 2006. This is the closest site to the project area for which ozone data has been collected recently. Particulate matter less than 2.5 microns in effective diameter ($PM_{2.5}$) background data was taken from a monitor located at the west entrance to Yellowstone National Park for the year 2006. This is believed to be the only rural $PM_{2.5}$ data collected in Montana for the year 2006. Background pollutant concentrations for these pollutants are compared to the MAAQS and NAAQS in Table 3.1-5.

As shown in Table 3.1-5, regional background values are well below established standards, and all areas within the cumulative study area are designated as attainment for all criteria pollutants. Background air quality concentrations are combined with modeled project-related air quality impacts of the same averaging time periods, and the total predicted impacts are compared to applicable air quality standards. These background values will be used in the modeling completed for the analysis of air quality impacts in this EA.

Federal air quality regulations adopted and enforced by the MDEQ-ARMB limit incremental emissions increases to specific levels defined by the classification of air quality in an area. The Prevention of Significant Deterioration (PSD) Program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined baseline level. Incremental increases in PSD Class I areas are strictly limited, while increases allowed in Class II areas are less strict. The project area and surrounding areas are classified as PSD Class II. The only mandatory federal PSD Class I areas located within 100 miles of the project area is the U.L. Bend Wilderness Area (approx. 50 miles SSW). The Fort Peck Indian Reservation (approx. 25 miles ESE) is also classified as a Class I area. However, it is protected as a Class I area under the MDEQ-ARMB. These sensitive areas have the potential to be impacted by cumulative

project source emissions. Regional background pollutant concentrations, as well as NAAQS, MAAQS, and PSD Class I and II Increments, are presented in Table 3.1-5.

All NEPA analysis comparisons to the PSD Class I and 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 as part of the New Source Review process for a major source, as would an evaluation of potential impacts to Air Quality Related Values (AQRV) such as visibility, aquatic ecosystems, flora, fauna, etc. performed under the direction of the MDEQ-ARMB in consultation with federal land managers, or would be conducted to determine minor source increment consumption.

Table 3.1-5. Air Pollutant Background Concentrations, Montana and National Ambient Air Quality Standards, and Prevention of Significant Deterioration (PSD) Increments (µg/m^3)

Pollutant/ Averaging Time	Measured Background Concentration	Montana and National Ambient Air Quality Standards	Incremental Increase Above Legal Baseline	
			PSD Class I	PSD Class II
Carbon Monoxide (CO) [1]				
1-hour (NAAQS)	1,725	40,000	n/a	n/a
1-hour (MAAQS)	1,725	26,450	n/a	n/a
8-hour	1,150	10,000	n/a	n/a
			n/a	n/a
Nitrogen dioxide (NO_2) [1]				
1-hour (MAAQS)	75	564	n/a	n/a
Annual (NAAQS)	6	100	2.5	25
Annual (MAAQS)	6	94	2.5	25
Ozone [2]				
1-hour (MAAQS)	124	196	n/a	n/a
8-hour (NAAQS)	116	157	n/a	n/a
Particulate Matter (PM_{10}) [1]				
24-Hour	30	150	8	30
Annual (MAAQS)	8	50	4	17
Particulate Matter ($PM_{2.5}$) [3]				
24-Hour (NAAQS)	11	35	n/a	n/a
Annual (NAAQS)	4.3	15	n/a	n/a
Sulfur dioxide (SO_2) [1]				
1-hour (MAAQS)	35	1,300	n/a	n/a
3-hour (NAAQS)	26	1,300	25	512
24-hour (NAAQS)	11	365	5	91
24-hour (MAAQS)	11	262	5	91
Annual (NAAQS)	3	80	2	20
Annual (MAAQS)	3	52	2	20

µg/m3 = micrograms per cubic meter

[1] Background data taken from MDEQ-ARMB, "Requirements for Submitting Air Dispersion Modeling Analyses," based on phone call with John Coefield of MDEQ-ARMB, 5-11-06.

[2] Background data taken from 2006 monitoring data collected at the CASTNET site located in Glacier National Park, MT (EPA/AIRS Database 2007).

[3] Background data taken from 2006 monitoring data collected in Yellowstone National Park, West Entrance (EPA/AIRS Database 2007).

Continuous visibility-related optical background data have been collected at the MDEQ-ARMB Class I Fort Peck Indian Reservation and the PSD Class I U.L. Bend Wilderness Area, as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. Visual range, referred to as standard visual range (SVR), is the farthest distance at which an observer can just see a black object viewed against the horizon sky; the larger the SVR, the cleaner the air. Visibility for the region is considered very good with an average SVR of over 150 km (Malm, 2000).

The MDEQ-ARMB, under its EPA-approved State Implementation Plan, is the primary air quality regulatory agency responsible for determining potential impacts once detailed industrial development plans have been made. Those development plans are subject to applicable air quality laws, regulations, standards, control measures, and management practices. Therefore, the MDEQ-ARMB has the ultimate responsibility for reviewing and permitting the project prior to its operation. Unlike the conceptual 'reasonable, but conservative' engineering designs used in NEPA analyses, any MDEQ-ARMB air quality preconstruction permitting demonstrations required would be based on very site-specific, detailed engineering values, which would be assessed in the permit application review. Any Proposed Action meeting the requirements set forth under the Administrative Rules of Montana (Chapter 8, Air Quality, Subchapter 7 – Permit, Construction and Operation of Air Contaminant Sources) will be subject to the MDEQ-ARMB permitting and compliance processes.

3.2 CULTURAL RESOURCES

Cultural resources are the physical evidence of past human activities. Generally 50 years or older, they can include sites, districts, or landscapes. Previous investigations indicate the study area has been occupied for at least 5,000 years. A variety of laws and mandates require federal regulators to take into consideration the impact of undertakings upon cultural resources.

The National Historic Preservation Act of 1966 established the National Register of Historic Properties (NRHP). Sites, objects, districts, and landscapes can be nominated to the NRHP on the basis of association with events that have made a significant contribution to the broad patterns of history (Criterion A), association with a culturally significant individual (Criterion B), embodiment of the distinctive characteristics of a type or period in method of construction (Criterion C), or the potential to yield important information about the history or prehistory of the area (Criterion D). Until recently, prehistoric sites have been considered only under Criterion D, and this is still the case for most prehistoric sites in the Bowdoin area.

In 1990 the National Park Service issued Bulletin No. 38 which gives guidelines for evaluating sites under Criteria A, B, and C in terms of the cultures that generated these sites. In practice, this means that the National Park Service is now directing cultural resource managers to evaluate prehistoric sites from the perspectives of the tribal history and culture in Montana. Sites, artifacts, landscapes, or districts that qualify under Criteria A, B, or C from the perspective of Native American history and culture are called Traditional Cultural Properties (TCPs).

The usefulness, appropriateness, and relevance of the guidelines continue to be a subject of debate among archaeologists, ethnographers, and federal and state cultural resource managers with regulatory responsibilities under Section 106 of the NHPA and various state and federal advisory bodies, including SHPOs and the Advisory Council. The BLM has sought to clarify its position by issuing According to Information Bulletin No. 92-177 on January 9, 1992 by the

Washington, DC Office of the BLM. The BLM is not required to follow Bulletin 38 (Bulletin 1992:2); however, BLM Manual 8100 states the term 'cultural resources' includes properties (sites or places but not practices or beliefs) of traditional cultural or religious importance to specified social and/or cultural groups. These properties must be related to a group's cultural practices, beliefs, or values that are widely shared, have been passed on through generations, and serve a recognized role in the maintenance of the group's identity.

The American Indian Religious Freedom Act (AIRFA) protects the rights of living peoples to the "access of sites, use and possession of sacred objects, and the freedom to worship through ceremonial and traditional rites." Unlike the NRHP, sites associated with AIRFA are often less than 50 years in age. Locations that have associated intangible spiritual values may or may not have archaeological materials present. The integrity of setting is often crucial for AIRFA-related issues. The immediate surroundings, including the viewshed, can be critical to religious practices (prayer, fasting, making offerings, etc.).

Executive Order 13007 directs federal managing agencies to accommodate access to sacred sites by traditional Indian practitioners and to protect those sites from impacts. Executive Order 13007 is applicable only on federal lands.

The Native American Graves Protection and Repatriation Act (NAGPRA) protects marked and unmarked Indian graves on public lands. This protection extends to associated and unassociated grave goods and items of cultural importance belonging to the tribe as a whole.

Results of the Inventory

From 1973 to 2005, 1,016 projects were conducted that included at least a portion of the study area (on file at the BLM Great Falls Field Station). These investigations examined approximately 78,000 acres. The exact number of acres is unknown because some acres were surveyed more than once, and other surveys extended outside the study area. Over 70 percent of the inventory reports are related to the construction of gas wells and associated structures such as pipelines and access roads. Wildlife habitat or livestock improvement projects and reservoir construction are the next-most common activities to require cultural resource investigations making up seven and four percent of the projects, respectively. Other activities involving cultural resource investigations include land development and exchanges; borrow and gravel pit excavations; bridge construction, repair, or replacement; buried cable or fiber-optic line installations; cemetery expansion; dam and dike construction, inspection, or repair; farming or range chiseling; highway/road construction or repair; irrigation, construction or improvement of recreational facilities; and railroad improvements. The inventoried acres are highest in the townships along Whitewater Creek, Nelson Reservoir, and the Milk River.

There are 1,420 recorded sites in the study area. This provides a site density of 18 sites per 1,000 acres investigated. Of the total sites, 1,220 are prehistoric and 200 are historic in age. Of these, one site is listed and 45 sites are eligible for listing on the NRHP.

The site listed on the NRHP includes the H. Earl Clack Service Station in Saco, Montana. The Clack Station was nominated for its architectural style and because it is an example of a former chain of regional gas stations in northern Montana.

The BNGPA contains an Area of Critical Environmental Concern (ACEC) named the Big Bend of the Milk River ACEC. This area contains two sites that are eligible for listing on the NRHP: the Beaucoup Site Complex (24PH188 and 24PH189) and the Henry Smith Buffalo Jump Site (24PH794). The Beaucoup Site Complex consists of two Besant and Avonlea sites that are in

excellent condition. The Henry Smith site is an NRHP-eligible Avonlea bison-kill site containing a variety of features, including bison-kill areas, drivelines, meat-processing areas, effigies, and stone rings. The site has been developed for interpretation and public education.

Prehistoric Sites

The prehistoric site types include 897 stone rings, 158 cairns, 50 other stone features, 12 bison kills, three cultural-material scatters, and 100 lithic scatters. The majority of the stone feature sites (stone rings, cairns, etc.) have not been recorded to current standards. The following provides a brief discussion of the feature/site types and their likely location within the study area.

Stone ring sites are defined by the presence of stone ring features. At least 7,227 stone rings are reported for the study area. This provides an average of 93 rings for every 1,000 acres inventoried. This is one of the highest densities observed in Montana. Based on the available evidence, the stone rings average 4.7 meters in diameter. This is interesting because it is 0.2 meters smaller than stone rings observed in central Montana (Deaver and Peterson 1999) and 0.4 meters smaller than in central North Dakota (Peterson et al. 2001). The reason for this is unknown, but it could represent a difference in family size or length of occupation. The rings in the study area average 5.1 rocks per circumference meter. This is slightly higher than that observed for the rest of the state, but is likely the result of smaller ring size (it is easier to form a heavy small ring than a heavy large ring). A number of studies have found that stone rings tend to be found in upland settings, especially along the edges of ridges (Deaver and Morter 1981; Deaver and Peterson 1999). A recent GIS study of stone rings in central North Dakota found that stone rings tend to be located within 100 meters of 9- to12-degree slopes. It has been speculated that the placement of these rings reflects the desire to be located near a variety of resources, as represented by xeric environments. However, a study by Peterson and others (2001) suggests that access to ring rock may have also been an important factor in ring placement. Although archaeologists tend to believe stone rings are associated with habitation structures, other tribes may disagree with this assessment and argue that stone rings can be the result of vision quest features. The Crow believe that some stone rings may be associated with human remains. The Assiniboine believe that stone rings with openings to the south are related to Assiniboine occupations.

Cairn sites are defined by the presence of cairns, though other artifacts and features may also be present. Cairns are the second-most common feature observed in the BNGPA. They are generally defined by a cluster of rocks, usually located in upland settings. One thousand eight-hundred and ninety cairns have been found within 338 sites. From the available evidence, the cairns in the study area average 1.42 meters in size and have a rock density of 21 rocks per square meter. This is slightly smaller and less dense than averages observed within 20 counties of Montana (Deaver and Peterson 1999). Although common, the function of cairns is not understood. They likely represent a variety of functions. Tribes often express concern over cairns, especially those over two meters in size, as they are sometimes associated with human remains.

In addition to stone rings and cairns, there are a small number of other stone features within the study area. As with stone rings and cairns, other stone features tend to be found in upland settings. Most of the features (138) in the study area represent alignments. Alignments are roughly linear arrangements of rocks or small rock clusters. Archaeologists have traditionally interpreted alignments to represent drivelines used to direct bison to a kill site; however, other interpretations such as prayer lines or medicine wheel remnants have also been given (Deaver and Peterson 1999). Other features observed in the BNGPA include effigies (especially of Napi

figures), a vision quest structure, and a medicine wheel. This site type would also include the Sleeping Buffalo Site, where a series of boulders on top of a ridge have the appearance of bison lying on the ground. Other stone features are often associated with ceremonial or religious activities. As such, they are commonly of concern to the tribes. In this region, Napi figures and medicine wheels are often ascribed to ancestral Blackfoot.

Bison kill sites are typically assigned to the location where bison were captured and killed, though they are sometimes ascribed to processing sites as well. The archetypical bison kill is represented by a high density of bison bone and numerous projectile points but few other artifacts. Bison kills are common along the Milk River in north-central Montana and most date to the Late Prehistoric Period (Deaver and Morter 1981). Unlike the other site types, bison kills tend to be situated near the base of ridges and are rarely found in upland settings. Tribes often identify bison kills as an important mnemonic of their past life and bison skulls are sometimes valued for ceremonial purposes.

Culture material scatters and lithic scatters represent prehistoric sites that are generally not associated with surface-visible features. While culture material scatters tend to be associated with a variety of artifacts (e.g. bone, pottery, stone tools, hearths), lithic scatters generally contain lithic debris and stone tools. The difference in artifact types is believed to be associated with the function of the site. Although these site types can occur anywhere, lithic scatters tend to be found in upland settings near lithic sources and culture material scatters tend to be found closer to water. Lithic scatters and culture material scatters found in plowed fields may represent remnants of stone ring or cairn feature sites.

Although not reported in the site files, there is one other site type found within the project area. The Larb Hills (24PH3878/24VL1777) also known as Saco Hills, was and continues to be an important plant-gathering location for the Fort Peck tribe. Of particular importance is the gathering of larb, which is used in ceremonial tobacco. As such it is identified as a traditional cultural landscape.

Historic Sites

Historic site types include homesteads, bridges, buildings, canals, cultural material scatters, cairns, dams, dikes, irrigation systems, depressions, foundations, farms, graffiti, roads, railroads, towns, wells, and rock alignments. The level of recording at many sites does not meet current standards.

Rural residential sites include those labeled as homesteads or farms, as well as sites containing associated features such as wells or foundations. The BNGPA contains 69 homestead sites, six farms, one dugout, one well site, and five foundations. The majority of the sites in this category are located along numerous small lakes and Whitewater Creek in the northwest portion of the project area. Other concentrations occur around Nelson Reservoir and Bowdoin Lake.

The buildings and towns category includes residential or other buildings not associated with homesteads or farms, and buildings that make up a town. Recreational cabins are also included in this category. Among the recorded sites in the Bowdoin project area, there are four labeled as ‘building’ or ‘structure’, one boathouse, 21 cabins, 17 commercial buildings, two schools, one town, and one trailer house. The sites in this category are concentrated around Nelson Reservoir (especially cabins), the Milk River, Lake Bowdoin, and the Burlington Northern Railroad.

The infrastructure category includes bridges, roads, railroads, and a railroad station. These sites are located throughout the project area. Prominent sites of this type include the Burlington Northern Railroad and Highway 2.

The irrigation category includes sites labeled as canals, dams, dikes, or irrigation systems. These sites are mainly concentrated along the Milk River, which is the main source of irrigation water in the project area. A few irrigation-related sites occur at Nelson Reservoir, Whitewater Creek, and Water Coulee.

This category contains an assortment of site types that do not fit into the other categories, including cultural material scatters, cairns, depressions, graffiti, petroglyphs, and rock alignments. These sites occur along Whitewater Creek and the Milk River, which is not surprising as this is the same area that contains the homesteads and other residential sites.

3.3 GEOLOGY

3.3.1 Regional Geologic Overview

The BNGPA lies northeast of Malta, in the northern part of the Upper Missouri River Watershed area, and is about equidistant from the Rocky Mountains (to the west) and the Black Hills Uplift (to the southeast). Regionally, the closest significant uplift to the BNGPA is The Little Rocky Mountains, a faulted anticlinal complex situated some 60 miles southwest of the town of Malta. Most of the BNGPA is contained within or proximal to the Bowdoin Dome (Collier, 1917; Erdmann and Schwabrow, 1932), a large yet topographically subdued structure with its surface expression confined to gently dipping Upper Cretaceous rocks.

Geologic mapping by the Montana Geological Survey (Colton and Patton, 1987*a*; Bergantino, 1999, 2003) documents that all exposed rocks and surficial sediments within the BNGPA are of Quaternary, Tertiary, and Late Cretaceous ages. These deposits are underlain by sedimentary rocks of Late Cretaceous through Cambrian age, which are in turn underlain by Precambrian plutonic and metamorphic basement rocks. Rock exposure in the BNGPA is generally poor due to the dominant subdued topography developed on the easily eroded Cretaceous Claggett Shale and Bearpaw Shale.

3.3.2 Quaternary Sediments

Quaternary sediments in the BNGPA include widespread alluvial floodplain, alluvial terrace, colluvial, and glacial deposits including large boulder erratics as well as weathering residuum (regolith soils) developed on Upper Cretaceous rocks, spring deposits, and mass-wasting (slump, earthflow, creep, and landslide) debris.

Quaternary deposits

Alluvial deposits consist of valley-fill, stream floodplain, and stream terrace gravels, sands, and muds. Valley fill and floodplain deposits are extensively developed in and proximal to the broad valley of the Milk River and the wider floodplains of its tributaries, especially Beaver Creek, Frenchman Creek, Larb Creek, Whitewater Creek, and the East Fork of Whitewater Creek, where they locally reach thicknesses exceeding 20 feet. Even thicker amounts of alluvium are probably developed proximal to the giant artificial abandoned oxbow lake of Nelson Reservoir. Lesser amounts of alluvium were deposited in the downstream parts of the valleys of Austin Coulee, Cottonwood Coulee, Lush Coulee, and Martin's Coulee, and in those parts of the

valleys of Cottonwood and Little Cottonwood Creeks that are near the confluence with the floodplain of the Milk River. Terrace gravels are developed sporadically throughout the BNGPA, but are especially well exposed on the high divides bordering Cottonwood and Little Cottonwood creeks. Strath terraces (flat, river-cut surfaces that are devoid of gravels) are well developed along the Milk River north of Nelson Reservoir, above Lush Coulee, and above the east side of the East Fork of Whitewater Creek.

Colluvium consists of an admixture of sand and mud and, occasionally, fine gravel that has been transported downward from topographically higher levels by means of slopewash activity. Within the BNGPA, colluvium is ubiquitously developed on the relatively gentle slopes between badland hills and in the laterally distal extremes of upland stream floodbasins.

Glacial deposits, including morainal sediments, outwash gravels, and erratics, are common in north-central Montana (Jensen and Varnes, 1964; Colton, et al., 1989). Within the BNGPA, glacial erratics were the only deposits of glacial origin seen; however, these boulders were encountered in obvious strewnfields upon every upland divide traversed and were commonly encountered as lag deposits mantling dissected topography. The largest erratic seen during this survey measures nine feet in length, although most appear to range from one to three feet in the long dimension.

Weathering residuum (regolith soils). All exposed Upper Cretaceous shales and mudstones within the BNGPA exhibit a thin (2- to 6-inch) rind of weathered debris formed by the actions of rainfall and temperature change in the present-day semiarid regime. These sediments are especially prone to weathering because of their high proportion of weakly bonded clay (phylosilicate) minerals. Actually an extreme type of immature soil, this shale and mudstone regolith is seasonally translocated downslope to form part of the colluvial debris prior to incorporation into alluvial sediments on stream floodplains.

Spring deposits. Dozens of freshwater springs occur within the BNGPA, and areas downstream from many of these features show substantial wetland area formation, and/or they act as water sources for artificial stock ponds. The majority of springs seen are developed at or very near the stratigraphic contact between the Upper Cretaceous Claggett Shale—an impervious unit of clay-dominated marine shale—and the relatively permeable sandstones at the base of the overlying Upper Cretaceous Judith River Formation (see also Osterkamp, 1968). Other springs appear to have their sources in buried, gravel-filled Tertiary and/or Quaternary channels (Colton and Patton, 1987*b*).

Mass-wasting deposits. Deposits of mass-wasting origin are those formed due to emplacement by gravity, commonly in concert with fluid supersaturation of either the mobile sediments themselves or a fluid-impervious contact between underlying beds and the sole of the mobile mass. *Slump* is mass-wasting in which either saturated or gravitationally unstable sediment moves downslope through a series of backward, curved rotations. Slumps generally develop rapidly, and are commonly formed on the steeper slopes of relatively unconsolidated sediment. *Earthflows* are formed by the rapid downward flow of slurry composed of supersaturated sediment. *Creep* refers to the relatively slow, gradual downward movement of a ‘skin’ of surficial sediment—commonly the surficial ‘sod’ of a grassy soil—and can take place over dozens, if not hundreds, of years. The term *landslide* has come to be so restricted in definition that it is generally not applicable to other than mountainous regimes—landslide debris now being defined as disaggregated detritus formed by: (1) free fall; (2) contact and comminution; and (3) slope flowage (cascade) phases. Most of what are termed landslide deposits in the civil engineering terminology are now perhaps best included in the terms *landslip*

or *debris-avalanche* deposits. *Landslips* are relatively rapidly formed mass-wasting deposits of similar origin as slumps, but with no backward rotation of the displaced sediment. Most sediment collapse in roadcuts, steep road dugways, or along steeper streambanks are landslips. *Debris-avalanches* are simply landslips but on a much larger scale.

Within the BNGPA, mass-wasting deposits of slump, landslip, and creep origin are very common. Landslips occur along the steeper cutbanks of every major stream and coulee in the Project Area, and vast areas of massive slumping dominate nearly every upland exposure of the Claggett Shale. In fact, in most areas, the Claggett shows myriad orders of slump features that commonly extend down to the floodplains of the principal streams. Major landslips of the Bearpaw Shale are developed along the upper reaches of Frenchman Creek. Creep, including the tensile separation of vegetated areas on slumped masses, is especially well-developed above Beaver Creek, in the W ½ of Section 17, T. 31 N., R. 33 W., but also occurs in several other areas. All of these mass-wasting phenomena suggest the possibility of potential hazards to future road and well pad construction, with landslip areas being the most hazardous, and upland areas with slump deposits (due to their ubiquitous distribution) being secondary.

3.3.3 Tertiary Rocks

Bergantino (1999) mapped deposits of “Miocene-Pliocene sands and gravels; possibly equivalent to the Flaxville Formation; up to 30 meters (100 feet) thick” on the Malta 30 x 60-foot Quadrangle, in an area only six-odd miles southwest of the southwestern extremity of the BNGPA. Within the BNGPA, Bergantino (2003) mapped extensive areas of these later Tertiary sands and gravels on high, upland surfaces east of the town of Whitewater and southeast of Teakettle Butte and on the high surfaces west of Whitewater. Examination of these sediments at several localities showed only a few exposures to have lithified gravel and conglomerate, whereas at most sites the gravels seem to be unconsolidated. Interestingly, these sediments (up to 100 feet thick as mapped by Bergantino and up to about 50 feet thick at the localities visited by us) seem to always cap the Judith River Formation; in no place were they seen lying atop exposures of the Claggett Shale (stratigraphically beneath the Judith River Formation). Bergantino (2003) recorded “cemented gravels” locally capping the Bearpaw Shale, but did not directly relate those sediments to those capping exposures of the Judith River Formation. Upland surfaces in the northwest-central part of the BNGPA (e.g. the area south of the town of Loring) are strewn with cobbles and boulders that ranchers have piled up at intervals along fences. These large clasts are derived from the Miocene-Pliocene gravels and strewnfields of glacial erratic boulders.

3.3.4 Upper Cretaceous Rocks

Although Bergantino (2003) mapped undifferentiated Hell Creek and Fox Hills formations along the Canadian border east of the upper reaches of Frenchman Creek, Mesozoic rocks exposed within the BNGPA are confined to the Upper Cretaceous Claggett Shale (bottom of section), Judith River Formation (middle of section), and Bearpaw Shale (top of section). The Claggett Shale is a marine shelf deposit equivalent to the lower part of the Mesaverde Formation developed farther to the south in southern Montana and Wyoming. The Judith River Formation is a continental (alluvial) deposit that is largely equivalent to the upper part of the nearshore bar, beach, and continental Mesaverde Formation and (possibly) to part of the (largely continental) Meeteetse Formation farther south. The Bearpaw Shale is a nearshore marine shale and thin, discontinuous shelf sandstone deposit approximately equivalent to the Meeteetse Formation farther to the south.

Bearpaw Shale consists of up to 1,000 feet of dark gray to brown marine shale and thin sandstones with interbeds of rusty brown and yellow concretions and occasional thin bentonites (Bergantino, 1999, 2003; Berg, 2002). The concretions commonly contain fossils of marine invertebrates. Bearpaw exposures are generally poor and vegetated, and because the formation caps all of the highest uplands in the BNGPA, it has been altered by cultivation in many areas.

The **Judith River Formation** consists of up to 450 feet of gray, brown, and yellow mudstone; thin brown sandstones; and thick multistory-multilateral channel deposits, all of fluvial origin. The Judith River lies conformably on the Claggett Shale, and the Judith River/Claggett contact is generally marked by a notable increase in slope due to the more resistant nature of the dominant Judith River sandstones. Even in vegetated areas, the Judith River is marked by significant exposure of the more highly indurated sandstones. Judith River sandstones locally contain dinosaur, crocodilian, and mammal remains.

The Judith River Formation is perhaps best exposed: (1) in the Cottonwood Creek and Little Cottonwood Creek and Austin Coulee areas north of the town of Malta; (2) south and southwest of the town of Saco in the drainage of First Creek and between Hay and Abrahamson Coulees; (3) east of the town of Whitewater and south of Teakettle Butte; and (4) southwest of the town of Hinsdale between Limekiln Coulee and McNab Coulee in the salient separating the valleys of Beaver Creek (on the north) and Larb Creek (on the west).

Claggett Shale. Although the base of this formation is not exposed within the BNGPA, the Claggett Shale consists of up to 450 feet of dark gray and brown shale and sandy shale of marine origin. Thin, flaggy sandstones and yellow and rusty concretionary zones are common near the top of the unit, and the concretions commonly exhibit septarian structure or, more rarely, contain fossil wood and the fragmentary shells of marine invertebrates.

3.3.5 Paleontological Resources

Quaternary Sediments

Sediments of Quaternary age, especially the alluvial and colluvial deposits, comprise about a third of the area of the BNGPA. It is always a possibility that excavations will reveal fossils in Pleistocene rocks; however, such finds are infrequent and are normally restricted to fragmentary specimens of modern or extinct species of bison, and of the even rarer extinct elephant *Mammuthus*. No monitoring of disturbances of Quaternary sediments is recommended; however, mitigating field scientists are encouraged to spot-check any major excavations into Quaternary deposits as their field time permits.

Tertiary Rocks

No fossils are known from the indurated gravels of presumed later Tertiary (Miocene-Pliocene) age within or proximal to the BNGPA. No spot-checking or monitoring of these rocks is recommended.

Bearpaw Shale

Regionally, the Bearpaw Shale has produced bones of marine reptiles; however, within the BNGPA, Bearpaw exposures are known to yield only fossil invertebrates (e.g., ammonites and decapods) and fossil wood. It is recommended that operations involving surface disturbance of Bearpaw sediments be briefly and periodically spot-checked.

Judith River Formation

Known for a century and a half for its production of dinosaur remains (Leidy, 1856), the Judith River Formation in the United States and Canada is known to produce specimens of pachycephalosaurs, ankylosaurs, raptors, spinosaurs, hadrosaurs, and ceratopsians (Sues, 1977, 1978; Wilson and Currie, 1985; Currie, 1987; Paul, 1988). Rare Cretaceous mammals also occur in Judith River rocks (e.g., Montellano, 1992), and the formation is one of the most critical of all in the Western Interior of North America for contributing to an understanding of Late Cretaceous dinosaurian faunas.

In the last several years, a series of dinosaur discoveries has been made both within and adjacent to the BNGPA. These discoveries include finds such as virtually complete skeletons and/or skulls of a variety of forms including the fossilized skin, stomach contents, and muscle bundles preserved in the round of a unique specimen of *Brachylophosaurus*. This last-mentioned specimen is possibly the best-preserved dinosaur known from anywhere in the world (Horner 2007).

Because of the abundant, well-preserved, and even unique dinosaur remains known from Judith River rocks within the BNGPA (including two sites—one a dinosaur bone-bed—currently under investigation), as well as current ongoing dinosaur prospecting surveys within the BNGPA now being undertaken by the Judith River Dinosaur Institute, it is recommended that any and all operations involving surface disturbance of rocks of the Judith River Formation be monitored by repeated visits to affected sites during the course of all road, well-pad and other construction. It is further recommended that Jack Horner at the Museum of the Rockies be apprised of the schedule of construction activity and that the scientists involved in spot-checking and monitoring coordinate their activities with him.

Claggett Shale

Within the BNGPA, the Claggett Shale yields only a few ammonites; however, bones of plesiosaurs and rare fossils of the bird *Hesperornis montanus* are known from the Claggett in other areas. It is recommended that operations involving surface disturbance of the Claggett Shale be briefly spot-checked.

3.3.6 Geologic Hazards

The most likely geologic hazards to affect oil or gas field development in the project area are mass movements or swelling clays.

Bergantino (1999) mapped a normal fault in the southeastern part of the area, between Hinsdale and Vandalia that cuts across US Highway 2. This fault is a Laramide (latest Cretaceous) feature that formed in response to gentle arching of the area. The fault is down-dropped to the southeast, forming the northern bounding fault of a small graben, about 1/4–1/8 mile wide. The southern edge of the graben, which is down-dropped to the northwest, was not mapped by Bergantino apparently because it is unseen in the surface. Displacement across either fault is minimal, probably less than 50 feet (Gmza 2007). Bergantino's map depicts the fault buried beneath alluvium preserved in Lime Creek and the Milk River. The fault is shown as dashed (or approximately located) at the surface through the Judith River Formation and Claggett Shale. It is also shown as dashed beneath Quaternary alluvium and colluvium on the north side of the Milk River implying that it cuts though those units, but this is probably a drafting error, and in reality, the fault does not cut this unit. There apparently is no evidence of reactivation of this fault in recent times, but that is always a possibility, albeit a very small one.

Mass Movements

Mass movement phenomena constitute a potential hazard for construction on steep slopes of the Claggett Shale and probably at and just beneath the contact of the Claggett Shale with the overlying Judith River Formation. On a regional scale, this contact is the source of many springs where water percolating through the relatively permeable sands of the Judith River Formation reaches the relatively impermeable Claggett Shale and is forced to migrate laterally. In the field, the Claggett/Judith River contact was seen to be the source of earthflows of Judith River rocks, as well as earthflows and slumps in the Claggett Shale, these last probably resulting from water percolating along joints and other fractures in the shale. Creep is also a common phenomenon in the report area and generally takes the form of the slow, downward movement of topsoil (weathered, vegetated Claggett Shale combined with eolian sediment). For the BNGPA, Godt (1997) classifies the region as one marked by moderate to high susceptibility to landsliding but with a low level of actual incidence of landslides.

Swelling Clays

Swelling clays can also pose a significant problem for well site construction in many areas. These clays commonly include illites and mixed-layer illite-smectites in which the lattice structure of the clays contains void spaces or in which the bond between clay minerals is weak (clays are sheet-like phyllosilicates). These spaces and weakly bonded surfaces can take on water causing the clays to swell when wet. Swelling can result in structural foundation damage as well as dislocation of surface structures not deeply embedded within the clays. Within the report area, both the Upper Cretaceous Claggett and Bearpaw formations are units dominated by clay shale, and Olive et al. (1989) record units in the Bowdoin Dome area as containing abundant clay with a high swelling potential.

3.3.7 Non-petroleum Resources

Non-fuel mineral resources within the BNGPA are limited to crushed stone and gravel that is used for a variety of construction (concrete aggregate, road metal, fill, rip-rap, ballast) and agricultural needs (McCulloch, 2004).

3.3.8 Oil and Gas

The oil and gas resources of the Bowdoin Dome (Montana Bureau of Mines and Geology, 2004) have been known since before World War I (Collier, 1917; Schroth, 1953; Crouch and Nydegger, 1976). Production on this structure is chiefly from relatively shallow (less than 3,000 feet) reservoirs in the Upper Cretaceous Carlile Shale, Mowry and Greenhorn Formations, and Belle Fourche Shale, and is from a combination of stratigraphic and structural traps (Rice and Shurr, 1980; Rice et al., 1990; Rice and Spencer, 1995; Condon et al., 2000; Ridgley et al., 2000, 2001*a*, 2001*b*). In the BNGPA, production from the Carlile Shale comes from the Bowdoin Sandstone, a facies equivalent of the shale that reaches about 300 feet in thickness near the town of Mosby. The Greenhorn Formation is about 250 feet thick in the Bowdoin Dome area where it is a principal gas-producing unit (Gautier et al. (1995). The Mosby Sandstone Member of the Belle Fourche Shale is known as the Phillips Sandstone on Bowdoin Dome, where it is a major gas-producing unit.

The potential for gas in deeper reservoir rocks that are older than Late Cretaceous in age, and for oil in the BNGPA, is unknown. The deepest well drilled in the Bowdoin Field had a total depth of 1,425 feet. The nearest oil production to the BNGPA in Valley County occurs about 35 miles to the east of the BNGPA in the Lustre Field (Section 2, T31N, R44E) where the Charles, Madison, Mission Canyon, and Radcliffe intervals produce oil and associated natural gas.

Cumulative oil production (bbls) from the field is 6,473,277 and post-1986 gas production (MCF) is 1,175,115. The deepest well drilled in Valley County (Section 9, T31N, R35E) had a total depth of 10,580 feet and was plugged and abandoned as a dry hole. The deepest well drilled in Phillips County (T35n, R27E) had a total depth of 7,035 feet and also proved to be a dry hole. There is no oil production in Phillips County.

3.4 WASTES, HAZARDOUS OR SOLID

The affected environment for releases of wastes or hazardous materials includes air, water, soil and biological resources that may be affected by the release in the course of transportation, use, or storage of the material in construction or field operations. Areas that are particularly vulnerable to the release of such materials include wetlands, waterbodies, areas of shallow groundwater and areas where wildlife and humans could be directly impacted.

The management of non-exempt hazardous and non-hazardous (solid) wastes is regulated under the RCRA (40 CFR Part 260-268) while the management of releases of hazardous materials into the environment is regulated under Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) (40 CFR Part 300-374). Oil and gas exploration, production, gas-gathering, processing wastes, and releases of hazardous materials into the environment are generally considered to be RCRA-exempt and are regulated by the Montana Board of Oil and Gas (MBOG) or the Montana Department of Environmental Quality (MDEQ) and the BLM.

Numerous companies operate within the BNGPA, and each has a responsibility to comply with the state and federal regulations applicable to their operations. Different companies have different compliance philosophies, ranging from minimal compliance to compliance programs that exceed regulatory requirements.

Solid and Hazardous Waste

There are no known hazardous-waste disposal sites associated with the gas operations within the BNGPA nor are there any known permitted solid-waste disposal units. Buried non-hazardous materials may be present in the project area in association with historic gas production operations, homestead locations, and agricultural operations.

WBIP injects methanol into the natural gas pipeline system and recovers water-contaminated methanol from the natural gas stream at various locations within its system. Methanol is used to keep water in the natural-gas stream from freezing and causing unsafe conditions during pipeline transportation. WBIP continually recycles methanol to minimize the need for disposal of this hazardous substance as a requirement of its Waste Minimization Policy. WBIP has implemented a company policy regarding the safe handling and transportation of methanol.

A **Hazardous Materials Management Summary** including types and quantities of hazardous and extremely hazardous materials that may be expected to be used, stored, transported, or disposed within the BNGPA is found in **Appendix C**. This summary includes the appropriate classification and management of hazardous and non-hazardous wastes generated by operations and applicable company management protocols. Operators are encouraged to substitute less-toxic, yet equally effective, products when available (Gold Book 2006) in all phases of operations. Substitutions are not always available; therefore, it is acknowledged that hazardous materials may be used in the BNGPA. All wastes are to be treated or disposed of in

an approved manner consistent with existing laws and regulations (Gold Book 2006). Non-exempt wastes will not be mixed with exempt wastes.

Drilling Mud

The BNGPA has been in continuous operation since 1929. Regulations and industry standards for the management of wastes have changed substantially since that time. Until the 1980s waste materials generated during drilling, production, and processing operations would typically have been buried near the point of generation within the field area. Reserve pit contents may have been buried at older producing or plugged and abandoned well sites. The disposal of these materials is now regulated and approved by the MBOG and the BLM. More recently the participating companies have recycled drilling mud between wells for re-use or provide it to area land-owners to use as reservoir or stock pond sealant. Both these practices reduce the volume of material to be disposed of. The BLM requires drilling pits to be pumped dry and either fenced or backfilled immediately upon well completion. If a liner has been used in the reserve pit, any liner material must be removed to below ground level before being covered (BLM 1989). Completion fluids are also recycled to the extent possible to minimize waste disposal but are generally produced to a pit on-site for disposal.

Produced Water

Since the beginning, the wells in this field have produced very small quantities of water. The volume of water produced in each well is dependent on which and how many gas zones are producing and where the well is located within the field. Older wells are generally completed in only one or two zones while some of the newer wells may be completed in numerous zones. Wells on the flanks of the structure generally produce more water than those on the crest. Water from wells producing less than 5 bbls of water per day (BWPD) is generally disposed of into an unlined pit at the well site. 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. BLM has approved the transportation of water within the field from wells which produce more than 5 BWPD to disposal in pits at sites where the wells produce less than 5 BWPD. Produced-water disposal is permitted through the BLM Onshore Oil and Gas Order Number 7 and the MBOG.

Migratory bird deterrent devices are generally not used at the produced-water disposal pits within the BNGPA 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 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.

Voluntary pit fencing, screening, and netting or sealing vessels are encouraged as methods to avoid potential instances that may result in the death of a migratory bird.

Hazardous Materials Releases and Spill Response

The participating companies each have trained personnel and the equipment needed to respond to releases of hazardous materials in the project area. As this is a gas field producing little or no condensate and no oil, the opportunity for a release to the environment is limited to

materials brought in for operations such as fuel, lube oils, mud products, and completion fluids. Releases of materials are reported to state and federal regulators as required. BLM NTL-3A is the appropriate mechanism for reporting spills, accidents, blowouts or other undesirable events that occur from federal minerals or on BLM-managed surface; otherwise, spills of hydrocarbon and hazardous materials are reported to MDEQ and MBOGC. Remediation of contaminated soils or off-site disposal of contaminated material is approved by BLM prior to the management action. Participating companies must comply with the applicable provisions of SPCC regulations of EPA found at 40 CFR 112. These regulations require secondary containment for mobile and non-mobile equipment that contains oil in volumes greater than 1,320 gallons that could impact navigable waters of the United States in the event the material was released. This rule applies to compressor stations, drilling operations and other activities within the BNGPA. Most Operators in the project area have prepared contingency plans that will be activated should there be an emergency or hazardous materials release.

Miscellaneous Waste Streams

Portable chemical toilets are provided for field activities such as construction, drilling, and completion operations, as are dumpsters or trash cages for the collection of non-hazardous solid wastes. Trash is also collected in individual containers or bags for off-site disposal. These waste materials are disposed of in accordance with state standards as imposed by the county sanitarian.

In the event flaring or venting of natural gas is required to facilitate safe operations, Operators comply with the notification provisions of BLM NTL-4A, which allows the flaring of gas in emergencies for up to 30 days or 50 MMCF with approval required thereafter.

All participating companies and their contractors are responsible for compliance with all applicable local, state, and federal regulations for environmental protection. The WBIP environmental compliance manual includes the following statement: “WBI Holdings, Inc. and subsidiary companies will meet or surpass local, state and federal environmental laws, rules and regulations in a cost-effective manner and will minimize environmental liabilities associated with the company’s activities.”

In the event that ‘diesel cores’ are to be taken during drilling operations, the BLM requires the use of a closed mud system with above-ground mud tanks to manage oil-based mud and diesel fuel lubricants. The Operator will also be required to provide a contingency plan for BLM review that will be implemented in the event of equipment failure during the coring operation.

3.5 WATER RESOURCES, SURFACE AND GROUND

Water resources within the BNGPA include both surface and groundwater resources. Surface water features include the perennial Milk River, numerous (primarily intermittent and ephemeral) tributary streams, lakes, reservoirs (larger reservoirs and smaller dams), ponds, springs, and abundant prairie pothole wetlands. Groundwater resources include free water contained within both shallow alluvial and deep bedrock aquifers that are or could be used for agricultural, domestic, and or/industrial purposes. Shallow aquifers are limited, however, and deep bedrock aquifers are relatively costly to develop due to depth. Water resource abundance, type, flow regime, and quality are inextricably linked primarily to landform, geology, climate, and soils of the area, as well as localized precipitation events.

3.5.1 Landform and Geology

The BNGPA is within the Northern Great Plains region and consists of gently rolling continental glacial till plains and rolling hills, slightly to heavily dissected by drainage systems, albeit mostly intermittent and ephemeral in nature. Grass-covered rangeland is interspersed with non-irrigated farmland in the uplands and, where soil and water permit, by irrigated farmland in the valleys. Shale and sandstone bedrock underlie the area (Bergantino 2003). The Pleistocene-age glaciers that covered this area retreated only about 11,000 years ago and deposited the glacial till that created the soil parent material and landforms that are present today. Glacial deposits have produced a variety of soils in the area, but the dominant soil texture is silt or clay loams that affect infiltration and runoff.

3.5.2 Climate and Precipitation

Climate

Northeastern Montana is relatively cool and dry. The BNGPA's climate regime is semi-arid continental, which is characterized by low precipitation, cold winters, warm summers, drier season during winter, and a somewhat well-defined May–June wet season. Annual precipitation over the BNGPA is approximately 10–13 inches. Winds average 11 miles/hour and are generally from the northwest throughout the year (WRCC 2006).

Precipitation

Average annual precipitation ranges from 10 inches at Whitewater to 11 inches at Loring. Average annual snowfall is relatively light. Precipitation is somewhat unevenly distributed throughout the year with the most precipitation falling in May, June, and July. At the Loring, Whitewater, and Saco weather stations, the highest average monthly precipitation of 2.79, 2.42, and 2.43 inches, respectively, occurs in June. The majority of precipitation falls as rain from frontal systems and thunderstorms. Average annual snowfall at Loring and Whitewater is 24.5 and 19.8 inches, respectively (WRCC 2006). The greatest snowfall at these stations occurs in January and February (WRCC 2006). Table 3.5-1 presents a summary of temperature and precipitation measurements recorded at these three weather stations (WRCC 2006).

Temperature. At the Saco station, temperatures average 10 °F in January and 69 °F in July. At the Loring station, temperatures average 5 °F in January and 67 °F in July. Temperatures may fluctuate widely during the course of a day in either winter or summer. The average diurnal range between maximum and minimum temperatures is from 20 °F to 30 °F (WRCC 2006).

Evaporation and evapotranspiration. Mean annual evaporation ranges from 35–40 inches within the BNGPA, exceeding mean annual precipitation by approximately 25 inches (USGS 2000). Most precipitation is lost through evaporation, transpiration, or runoff. Approximately 80–90 percent is lost through evaporation and transpiration, while about 9–19 percent is lost as runoff, which leaves generally less than one percent to recharge groundwater aquifers. Average annual runoff is approximately 0.5 inch (BLM 1989).

Table 3.5-1. Temperature and Precipitation Data

Station	January Temperature (°F)			July Temperature (°F)			Annual Precip. (inches)	Avg. Total Snowfall (inches)
	Mean	Avg. Max	Avg. Min	Mean	Avg. Max	Avg. Min		
Loring 10N (northerly station)	5.0	17.7	-5.2	67.3	83.7	50.1	11.67	24.5
Whitewater (central station)	Insufficient data						10.70	19.8
Saco 1NNW (southerly station)	10.3	22.7	-2.0	68.9	84.2	53.6	11.43	n/a*

Source: NCDC Coop Stations, temperature and precipitation data from WRCC website (http://www.dri.edu/summary/climsmmt.html), July 2006.
* The WRCC website reports 2.0 inches average total snowfall, but this value appears erroneous as compared to nearby station values, is likely incorrect, and was not used.

3.5.3 Surface Water Quantity

Surface-water features within the BNGPA include perennial, intermittent, and ephemeral streams; several lakes, reservoirs and ponds; seeps/springs; and prairie pothole wetlands. The BNGPA lies within the Milk River Watershed, USGS Hydrologic Unit Code (HUC) 100500 of the Upper Missouri River Basin. Approximately 93 miles of the perennial Milk River (river miles) flows from west to east across the southern portion of the BNGPA, and joins the Missouri River near Nashua, Montana, approximately 35 miles southeast of the BNGPA. The BNGPA covers portions of seven sub-basins of the Milk River Watershed (Table 3.5-2). The BNGPA falls mainly within the Whitewater (37 percent of the project area), Middle Milk (32 percent of the project area), and Beaver (20 percent of the project area) sub-basins of the Milk River. Approximately 87 percent of the Whitewater sub-basin lies within the BNGPA, whereas 12 percent of the Middle Milk, 14 percent of the Beaver, 21 percent of the Frenchman, and minor percentages of the other three sub-basins lie within the project area (Table 3.5-2).

Table 3.5-2. BNGPA Surface Water Bodies by Sub-Basin

Sub-Basin[1]	Sub-Basin Area (acres)	Project Area within Milk River Watershed (by sub-basin) (%)	Project Area within Sub-basin (%)	Major Stream/Tributary	Major Lakes or Reservoirs
Whitewater 10050011	341,191	87.14	36.58	• Whitewater Creek • East Fork Whitewater Creek	• Whitewater Lake (665 ac.) • Austin Lake (225 ac.) • Pea Lake (157 ac.)
Middle Milk 10050004	2,246,634	11.74	32.45	• Milk River • Little Cottonwood Creek • White Creek • Frenchman Creek • Cottonwood Creek	• Martin Lake (252 ac.) • Hewitt Lake (250 ac.)
Beaver 10050014	1,169,725	13.93	20.05	Beaver Creek	Nelson Reservoir (4,114 ac.)
Frenchman 10050013	170,256	21.42	4.49	Frenchman River	
Lower Milk 10050012	975,289	2.71	3.25	Antelope Creek	
Cottonwood 10050010	580,619	2.39	1.71	Cottonwood Creek	
Rock 10050015	554,344	2.15	1.47	Rock Creek	

[1] Per USDA-NRCS fourth-code sub-basin boundaries

Source: Montana Natural Resource Information System, Digital Atlas of Montana, 2007

Streams

The main tributaries to the Milk River within the BNGPA include Cottonwood Creek (intermittent), Little Cottonwood Creek (intermittent), Whitewater Creek (perennial), White Creek (intermittent), Frenchman River (perennial), and Beaver Creek (perennial). Most of the drainageways within the BNGPA are intermittent or ephemeral, but may become perennial near the confluence with the downgradient water, typically the Milk River. Sub-basins of the Milk River and the associated streams that occur within the BNGPA are depicted on Figure 3.5-1.

Lakes and Reservoirs

Several lakes and reservoirs occur within the BNGPA, including Nelson Reservoir, Whitewater Lake, Austin Lake, Pea Lake, Hewitt Lake, and Martin Lake, to name a few of the larger waterbodies. Abundant prairie pothole wetland features dot the landscape in this general region, especially in the Whitewater Watershed.

The major lake or reservoir waterbodies within the BNGPA by sub-basin include:

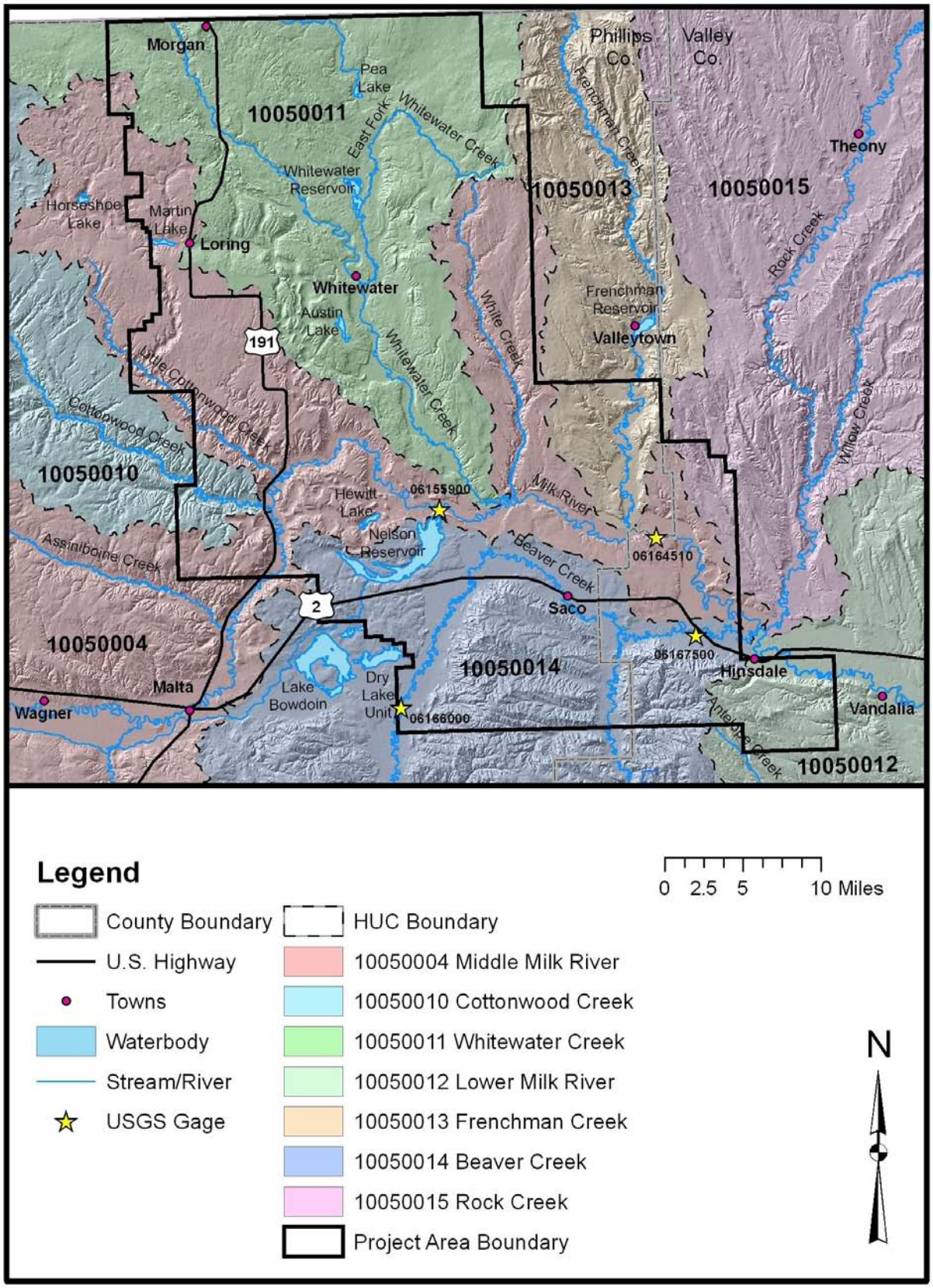
- Whitewater Watershed (10050011) Whitewater Lake, Austin Lake, Pea Lake
- Middle Milk Watershed (10050004) Hewitt Lake, Martin Lake
- Beaver Watershed (10050014) Nelson Reservoir

Because of the dominance of ranching in the area, numerous smaller dams (primarily 0 to 50 feet in height) with associated surface water are found throughout the BNGPA (DNRC 2006 and NRIS 2006).

Prairie Potholes

Prairie potholes are abundant within BNGPA. The Whitewater watershed, which covers approximately 37 percent of the project area, has been identified as one of the five significant areas in Montana where prairie potholes occur (Crowe and Kudray 2003). Montana potholes are very small (typically less than 2.5 acres, although some are larger) and generally much drier, with standing water only present perhaps one year in five due to the semi-arid climate. Virtually all are grazed, and many have been altered hydrologically (impounded and/or excavated) to provide water for livestock or wildlife habitat.

Figure 3.5-1. Surface Water Resources Associated With the BNGPA



Streamflow

Streamflow rates, volumes, and duration vary widely within the BNGPA, depending primarily on response to localized precipitation and overall seasonal fluctuations. As previously mentioned, most of the drainageways are intermittent or ephemeral. However, perennial flows do occur within some of the major drainageways in the BNGPA such as the Milk River, Whitewater Creek, Frenchman Creek, and Beaver Creek. Flows in unregulated streams have large seasonal variations with the largest flows generally occurring during spring or early summer as a result of snowmelt and intense rainfall events. Peak flows on prairie streams occur in March or April resulting from snowmelt. Larger peak flows on small drainages can occur from intense summer thunderstorms. Summer rainstorms can result in short intervals of increased streamflow during June through September. During winter, streamflow in prairie streams is greatly reduced or absent as a result of ice formation and little groundwater inflow (BLM 1992).

Four currently active USGS streamflow gauging stations are found within the BNGPA (USGS 2006). Two are on the Milk River, and two are on Beaver Creek. The upgradient Milk River station is located 500 feet upstream from the Nelson Reservoir Canal. The downgradient Milk River station is located approximately seven miles northeast of Saco, 1.5 miles downstream of the confluence with Frenchman Creek. The upgradient Beaver Creek station is located roughly 13 miles southwest of Saco, close to the southern boundary of the BNGPA. The downgradient Beaver Creek station is located approximately 4.5 miles northwest of Hinsdale, roughly five miles upstream of Beaver Creek's confluence with the Milk River. Figure 3.5-1 depicts the locations of these four USGS streamflow monitoring sites, and they are described in further detail as follows:

- **Station 06155900 Milk River at Cree Crossing, near Saco, MT**
  This station is operated in cooperation with the Montana Department of Natural Resources and Conservation. The period of record is May 2000 to present. This site is located within the Milk River sub-basin, on the Milk River, 500 feet upstream from the Nelson Reservoir Canal. The drainage area upstream of this gauge is 13,118 square miles. The mean monthly streamflow values for the entire period of record at this location ranges from a low of 32 cubic feet per second (cfs) in October to a high of 404 cfs in March. The maximum monthly values of the entire period of record ranges from a low of 50 cfs in October (2005 water year) to a high of 1,196 cfs in March (2004 water year). The highest daily mean flow of 3,800 cfs occurred March 15, 2004, while the lowest daily mean flow of 2.6 cfs occurred on May 28, 2001. The mean annual streamflow ranges from 33 cfs* in 2001 to 293 cfs* in 2004 (*incomplete data is used for statistical calculations; no data exists for November through February due to ice-over). This is presently a real-time streamflow monitoring station, and streamflow on July 25, 2006 was 146 cfs.

- **Station 06164510 Milk River at Juneberg Bridge, near Saco, MT**
  The period of record is October 1977 to present. This site is located within the Milk River sub-basin, on the Milk River, 1.5 miles downstream from the Frenchman River confluence, and near the downstream edge of the BNGPA. The drainage area upstream of this gauge is 17,670 square miles. The mean monthly streamflow values for the entire period of record at this location ranges from a low of 117 cfs in January to a high of 979 cfs in March. The maximum monthly values of the entire period of record ranges from a low of 271 cfs in January (1987 water year) to a high of 6,221 cfs in April (1978 water year). The mean annual streamflow ranges from 70 cfs in 2001 to 1,042 cfs in 1978. This is presently a real-time streamflow monitoring station, and streamflow on July 25, 2006 was 289 cfs.

- **Station 06166000 Beaver Creek below Guston Coulee, Near Saco, MT**
  This station is operated in cooperation with the U.S. Fish and Wildlife Service (USFWS). The period of record is April 1920 to September 1921, and April 1981 to present. This site is located within the Beaver Creek sub-basin, on Beaver Creek, where the stream enters the southern boundary of the BNGPA. The drainage area upstream of this gauge is 1,208 square miles. The mean monthly streamflow values for the entire period of record at this location ranges from a low of 6.7 cfs in August to a high of 64.5 cfs in March. The maximum monthly values of the entire period of record ranges from a low of 40.7 cfs in August (1993 water year) to a high of 1,187 cfs in September (1986 water year). The highest daily mean flow of 11,900 cfs occurred September 27, 1986, while the lowest daily mean flow of zero occurred on April 5, 1981. The mean annual streamflow ranges from 1.0 cfs* in 2000 to 270 cfs* in 1986 (*incomplete data is used for statistical calculations; no data exists for November through February due to ice-over). This is presently a real-time streamflow monitoring station, and the stream was dry on July 25, 2006 (in 2006, streamflow ended at this location on June 29).

- **Station 06167500 Beaver Creek near Hinsdale, MT**
  The period of record is October 1917 to August 1921, recommissioned in 2006 as a real-time streamflow monitoring station. This site is located within the Beaver Creek sub-basin, on Beaver Creek, approximately five miles upstream from the Milk River confluence and four miles upstream from the BNGPA's eastern boundary. The drainage area upstream of this gauge is 1,785 square miles. The mean monthly streamflow values for the entire period of record at this location ranges from a low of 0.5 cfs in January to a high of 239 cfs in April. The mean annual streamflow for the period of record is 116 cfs. This is presently a real-time streamflow monitoring station, and streamflow on July 25, 2006 was 31 cfs.

3.5.4 Surface Water Quality

The federal Clean Water Act (CWA) and Montana's Water Quality Act require an ongoing program of water quality assessments and reporting as part of a process intended to protect and improve the quality of rivers, streams, and lakes in the state (MDEQ 2006). The CWA requires states to adopt standards for protecting surface water quality. Montana has adopted water quality standards (ARM 17.30.601) and anti-degradation rules (ARM 17.30.701) for surface waters. Montana's standards are designed to conserve water by protecting, maintaining, and improving the quality and potability of water that will support the beneficial uses identified by the Montana Water-Use Classification System. Classifications assigned by this system require waters to support some or all of the beneficial uses listed below. The water quality standards employed to maintain these uses address parameters such as coliform, dissolved oxygen, pH, turbidity, temperature, color, toxics and other harmful substances. The non-degradation rules apply to any activity that may affect the quality of surface and groundwater.

Beneficial Uses

Montana waterbodies (including rivers, streams, lakes and wetlands) are classified according to the present and future beneficial uses that they should be capable of supporting (75-5-301 MCA). The State Water-Use Classification System (ARM 17.30.606-629) identifies the following beneficial uses:

- Drinking, culinary use, and food processing
- Aquatic life support for fishes and associated aquatic life, waterfowl, and furbearers
- Bathing, swimming, recreation, and aesthetics

- Agricultural water supply
- Industrial water supply

Use Classification

Water bodies are classified primarily by: (1) the level of protection they require; (2) the type of fisheries they support (warm or cold water) or; (3) their natural ability to support use for drinking water, agriculture, etc. The designated beneficial uses for each class in the system are as follows:

A-Closed. Waters are suitable for drinking, culinary, and food processing purposes after simple disinfection.

A-1. Waters are suitable for drinking, culinary, and food processing purposes after conventional treatment for removal of naturally present impurities.

B-1. Waters are suitable for drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

B-2. Waters are suitable for drinking, culinary, and food-processing purposes after conventional treatment; bathing, swimming, and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

B-3. Waters are suitable for drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

C-1. Waters are suitable for bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

C-2. Waters are suitable for bathing, swimming, and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

C-3. Waters are suitable for bathing, swimming, and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl, and furbearers. The quality of these waters is naturally marginal for drinking, culinary and food processing purposes, agriculture, and industrial water supply. Degradation which will impact existing or established uses is not allowed.

I. The State of Montana has a goal to improve these waters to fully support the following uses: drinking, culinary, and food-processing purposes after conventional treatment; bathing, swimming, and recreation; growth and propagation of fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

A summary of the designated beneficial water uses by these classifications is presented in Table 3.5-3.

Table 3.5-3. Designated Beneficial Uses by Water Body Class

Beneficial Uses	WATER BODY CLASS							
	A-Closed	A-1	B-1	B-2	B-3	C-1	C-2	C-3
Drinking Water (Human Health)	X	X	X	X	X			M
Agriculture	X	X	X	X	X	X	X	M
Industry	X	X	X	X	X	X	X	M
Aquatic Life	X	X	X	X	X	X	X	X
Recreation	X	X	X	X	X	X	X	X
Cold Water Fisheries (salmonid)	X	X	X	X		X	X	
Warm Water Fisheries (non-salmonid)					X			X

Source: (MDEQ 2004)
X = Beneficial use
M = Marginal use (may exist)

Assessment Status Categories

Under Section 303(d) of the CWA, states have been required to submit their lists (termed 303(d) lists) of impaired or threatened waters to the EPA every two years. When water-quality monitoring data reveal changes to the natural conditions that exceed those allowed by the state standards, the water is determined to be impaired (does not fully meet standards) or threatened (is likely to violate standards in the near future). Under requirements of the CWA, any water found to have one or more impaired or threatened uses must be placed on a list of water for which a 'water quality management plan' must be developed to correct the causes of the impairment. In those cases where the impairment involves the need to reduce the amount or concentration of specific pollutants, the water-quality management planning process must identify the total maximum daily load (TMDL) of each pollutant causing the exceedance(s). A schedule for the development of water-quality management plans (including a schedule for developing TMDLs where necessary) is a required element of these 303(d) lists. A category of 1–5 is assigned to each stream segment to indicate the assessment status and TMDL development needs for the stream segment.

Category 1: Waters for which all applicable beneficial uses have been assessed and all uses are determined to be fully supported.

Category 2: Waters for which those beneficial uses that have been assessed are fully supported, but some applicable uses have not been assessed.

In 2006, the EPA revised the Category 2 definition to: Available data and/or information indicate that some, but not all of the beneficial uses are supported. Therefore, two new subcategories are as follows:

- 2006 Category 2A: Available data and/or information indicate that some, but not all of the beneficial uses are supported.
- 2006 Category 2B: Available data and/or information indicate that a water quality standard is exceeded due to an apparent natural source in the absence of any identified anthropogenic sources.

Category 3: Waters for which there is insufficient data to assess the use support of any applicable beneficial use, so no use determinations have been made.

Category 4: Waters where one or more beneficial uses have been assessed as being impaired, fully supporting but threatened, all TMDLs are completed but impaired beneficial uses have not yet achieved fully supporting status, or impaired and TMDLs are not required.

Category 5: Waters where one or more applicable beneficial uses have been assessed as being impaired or threatened, and a TMDL is required to address the factors causing the impairment or threat.

BNGPA Water Bodies on the 303(d) List, 2006

Within and downstream of the BNGPA, nine stream segments and two waterbodies have been assessed by the Montana Department of Environmental Quality (MDEQ) and have listed impairments on the 303(d) list (Table 3.5-4). These include segments of the Milk River, Beaver Creek, Cottonwood Creek, Whitewater Creek, Frenchman Creek, Larb Creek and Nelson Reservoir. In general, these B-3 waters are suitable for all beneficial uses to some degree, except for the growth and propagation of salmonid fishes and associated aquatic life. The probable causes and sources of impairment in all cases vary, but generally are related to agricultural practices. Stream segment use classifications and assessment status categories are provided in Table 3.5-4.

Table 3.5-4. Summary of State and Federal Water Quality Act Listed Water Bodies Within the BNGPA

Segment Name and Number	Size	Use Class	Probable Causes / *Probable Sources* of Impairment	Water Quality Category
Milk River MT40J001_010	270.4mi. From Fresno Dam to Whitewater Crk	B-3	Mercury / *Agriculture, dam or impoundment, natural sources*	5—One or more uses are impaired and a TMDL is required.
Milk River MT40J001_020	38.2 mi. From Whitewater Crk to Beaver Crk	B-3	Alteration in stream-side or littoral vegetative covers / *Crop production (crop land or dry land), irrigated crop production, rangeland grazing* Iron / *Natural sources* Nitrates / *Crop production (crop land or dry land), irrigated crop production, rangeland grazing* Other flow regime alterations / *Flow alterations from water diversions*	5—One or more uses are impaired and a TMDL is required.
Cottonwood Creek MT40J005_020	54.1 mi. Black Coulee to the mouth (Milk River)	B-3	Alteration in stream-side or littoral vegetative covers / *Grazing in riparian or shoreline zones, natural sources, source unknown* Iron / *Natural Sources* Sedimentation/Siltation / *Grazing in riparian or shoreline zones, natural sources, source unknown*	5—One or more uses are impaired and a TMDL is required. 2B—Available data and/or information indicate that a water quality standard is exceeded due to an apparent natural source in the

Segment Name and Number	Size	Use Class	Probable Causes / *Probable Sources* of Impairment	Water Quality Category
				absence of any identified anthropogenic sources.
Whitewater Creek MT40K001_010 (both stream and waterbody segments)	61.7 mi. Canadian border to the mouth (Milk River)	B-3	Mercury / Source unknown	5—One or more uses are impaired and a TMDL is required.
Frenchman Creek MT40L001_010	74.5 Canadian border to the mouth (Milk River)	B-3	Alteration in stream-side or littoral vegetative covers / *Agriculture, dam or impoundment, grazing in riparian or shoreline zones* Chlorophyll-a / *Source unknown* Low flow alterations / *Dam or impoundment*	5—One or more uses are impaired and a TMDL is required.
Beaver Creek MT40M001_020	81.3 mi Black Coulee to the mouth of the Milk River	B-3	Alteration in stream-side or littoral vegetative covers / *Agriculture* Nitrogen (Total) / *Agriculture* Phosphorus (Total) / *Agriculture* Physical substrate habitat alterations / *Agriculture* Uranium / Source unknown	5—One or more uses are impaired and a TMDL is required.
Larb Creek MT40M002_020	73.8 headwaters to mouth (Beaver Creek)	B-3	Alteration in stream-side or littoral vegetative covers / *Agriculture, animal feeding operations (NPS), natural sources, source unknown* Copper / *Natural sources* Lead / *Natural sources* Oxygen, Dissolved / *Source unknown* Phosphorus (Total) / *Animal feeding operations (NPS), natural sources, source unknown* Total Kjehldahl Nitrogen (TKN) / Animal feeding operations (NPS), natural sources, source unknown	5—One or more uses are impaired and a TMDL is required. 2B—Available data and/or information indicate that a water quality standard is exceeded due to an apparent natural source in the absence of any identified anthropogenic sources.

Segment Name and Number	Size	Use Class	Probable Causes / *Probable Sources* of Impairment	Water Quality Category
Nelson Res. MT40M003_020 (both stream and waterbody segments)	3901.7 ac.	B-3	Other flow regime alterations / *Impacts from hydrostructure flow regulation/modification* Phosphorus (Total) / Irrigated crop production	5—One or more uses are impaired and a TMDL is required.
Milk River MT40O001_010	135.9 mi From Beaver Crk to mouth of Missouri River	B-3	Fecal Coliform / *Agriculture, dam or impoundment* Lead / *Source unknown* Mercury / *Source Unknown*	5—One or more uses are impaired and a TMDL is required.

Source: MDEQ 2004

Surface-Water Quality Monitoring Data

A paucity of water quality data exists for the smaller tributaries that may be impacted within the BNGPA. There are few perennial streams within the project area, and they may only be perennial at the confluence of the Milk River, for instance, and then become intermittent and ephemeral upstream.

Surface water quality in semi-arid regions is typically seasonal and dependent on the magnitude and frequency of discharge. The susceptibility of the BNGPA to erosion varies widely. The soils most susceptible to erosion occur in the Sedimentary Uplands Physiographic Province, including the Frenchman and Cottonwood Breaks in Phillips County (BLM 1992).

Various parameters are used to evaluate water quality. The BNGPA is predominantly used for livestock, grain cultivation, and oil and gas development (NRIS 2006). Water quality constituents of concerns in the project area include total suspended solids (TSS), salinity or total dissolved solids (TDS), nutrient enrichment, and some trace metals. Erosive and saline soils naturally occur within and around the BNGPA. Once the soil is disturbed, the potential for the release of residual soil sediment is increased. It is possible that oil and gas activities in the general area have and will continue to contribute to both sedimentation and salinity levels of the Milk River. TSS concentrations and sediment yield (or load) are used to asses runoff and erosion concerns; TDS concentrations, specific conductance, pH, hardness, and sodium adsorption rates (SARs) are used to evaluate salinity; and temperature, dissolved oxygen (DO) and nutrients are used to evaluate aquatic habitat.

Three of the four USGS streamflow gauging stations on the Milk River and Beaver Creek that were discussed in the Surface Water Quantity section are also established water quality monitoring stations (06155900, 06164510, and 06166000). Specific conductance and temperature, as well as dissolved solids, nutrients, and sodium adsorption ratio (SAR) are constituents that are primarily evaluated, as they are typically indicators for the evaluation of water for various uses. Notable parameters such as TSS and trace metals have not been included. Because only temperature and specific conductance have been monitored at the upgradient Milk River station (06155900), comparisons of water quality with the downstream Milk River station (06164510) are difficult to analyze. Similarly, only one water-quality monitoring station within and near the BNGPA exists on Beaver Creek, which precludes comparison and trend analyses for that stream. Data are available on the USGS website (USGS 2006) and are summarized in Tables 3.5-5, 3.5-6, and 3.5-7.

Table 3.5-5. General Water Quality of the Milk River at USGS Station 06155900 Milk River at Cree Crossing Near Saco, MT

Parameter	Mean	Median	Range	No. of Samples	Period of Record
Temperature (^oC)	11.21	13	0–26	29	2000–2004
Instantaneous Discharge (cfs)	304.06	71	4.7–3,490	29	2000–2004
Specific Conductance (µS/cm)	1,022.99	1,010	330–1,870	29	2000–2004

Table 3.5-6. General Water Quality of the Milk River at USGS Station 06164510 Milk River at Juneberg Bridge Near Saco, MT

Parameter	Mean	Median	Range	No. of Samples	Period of Record
Temperature (^oC)	9.55	8.75	0–27	240	1977–2004
Instantaneous Discharge (cfs)	668.85	151	2–10,500	237	1977–2004
Specific Conductance (µS/cm)	1,033.89	1,020	202–2,020	237	1977–2004
pH (standard units)	7.97	8	7.3–8.7	29	1977–1980
Total Hardness as $CaCO_3$ (mg/L)	317.53	290	80–540	55	1977–1982
SAR (unitless)	3.51	4	2–5	55	1977–1982
Nitrite + Nitrate as nitrogen (mg/L)	0.24	0.16	0–1.7	79	1977–1983
Phosphorus (mg/L)	0.02	0.02	0–0.14	85	1977–1990
TDS, sum of constituents (mg/L)	776.56	728	210–1,370	55	1977–1982

Table 3.5-7. General Water Quality of Beaver Creek at USGS Station 06166000 Below Guston Coulee Near Saco, MT

Parameter	Mean	Median	Range	No. of Samples	Period of Record
Temperature (^oC)	13.36	14	0–28	70	1980–2004
Instantaneous Discharge (cfs)	168.57	16.5	0.04–1,960	70	1980–2004
Specific Conductance (µS/cm)	832.30	660	200–31,000	63	1982–2004
pH (standard units)	8.05	8.1	7.1–8.7	24	1980–1985
Total Hardness as $CaCO_3$ (mg/L)	317	180	51–1,200	15	1980–1982
SAR (unitless)	2.47	2	2–5	15	1980–1982
Nitrite + Nitrate as nitrogen (mg/L)	0.21	0.1	0–0.61	8	1980-1985
Phosphorus (mg/L)	0.04	0.035	0.01–0.1	20	1980–1985
TDS, sum of constituents (mg/L)	674.20	352	148–2,570	15	1980–1982

3.5.5 Waters of the U.S.

Most surface water features in the BNGPA qualify as Waters of the U.S. Prairie potholes, however, would likely need to be evaluated on a case-by-case basis, based upon a 'significant nexus' to other Waters of the U.S. (e.g., their surface water connectivity to other jurisdictional waters). Irrigation ditches, also, would likely need to be evaluated on a case-by-case basis, as a result of the Talent Decision (2001). Waters of the U.S. include the territorial seas, interstate waters, navigable waterways (such as lakes, rivers, and streams), special aquatic sites, and wetlands that are, have been, or could be used for travel, commerce, or industrial purposes; tributaries, and impoundments of such waters. All channels that carry surface flows and that show signs of active water movement are Waters of the U.S. Similarly, all open bodies of water (except ponds and lakes created on upland sites and used exclusively for agricultural and industrial activities or aesthetic amenities) are Waters of the U.S. (EPA 33 CFR § 328.3(a)). Such areas are regulated by the EPA and Department of Army Corps of Engineers (COE). Any activity that involves discharge of dredge or fill material into or excavation of such areas is subject to regulation by the COE pursuant to Section 404 of the CWA. Activities that modify the morphology of stream channels are also subject to regulation by the COE. Special aquatic sites and wetlands are discussed in greater detail in section **3.11.3. Wetlands and Riparian Zones**.

3.5.6 Groundwater Quantity

Shallow groundwater (less than 500 feet below land surface) is scarce or absent within the general area (BLM 1989, 1992). Shallow aquifers occur in the Quaternary alluvium of major drainages, in buried pre-glacial alluvial channels, and terrace deposits. Depth, yield, and quality vary widely. Yields range from one to 100 gallons per minute (gpm), but average 2 to 5 gpm. This shallow water is generally marginal for domestic use due to high TDS concentrations (1,000 to 5,000 mg/L), but suitable for livestock and wildlife use (BLM 1989).

Deeper aquifers (greater than 500 feet below land surface) include the Upper Cretaceous Bearpaw Shale, Judith River Formation and Claggett Shale (Lawlor 2000), and the much-deeper Mississippian Madison Limestone. Except for the Madison, these aquifers are generally marginal to unsuitable for domestic use due to exceedingly high TDS levels. Depths of these aquifers range from 700 to 4,000 feet, making them generally too deep to be economical for livestock and wildlife use. The Madison Aquifer is generally suitable for domestic use, but again, its depth increases cost.

Primary hydrogeologic units in the general area that contain water used for domestic and stock supplies are Quaternary alluvium and glacial deposits and the Upper Cretaceous Judith River Formation. Quaternary alluvium and glacial deposits are underlain by the Upper Cretaceous Bearpaw Shale, Judith River Formation, or Claggett Shale (Lawlor 2000). The Bearpaw Shale and Clagget Shale are relatively impermeable. Any water withdrawn from the Bearpaw and Clagget Shale units would likely be too mineralized for domestic, stock, and irrigation purposes.

3.5.7 Groundwater Quality

The Lawlor study (2002) of the quality of groundwater along the Milk River Valley, from Havre, Montana, to its mouth near Nashua, Montana, applies to the project area along the Milk River and in similar formations. Most of the wells in this inventory were completed in either the Quaternary alluvium and glacial deposits or the Upper Cretaceous Judith River Formation. TDS concentrations ranged from 432 mg/L to 3,550 mg/L, with a median of 1,655 mg/L. Groundwater

from sampled wells generally was suitable for stock watering based on TDS concentrations less than the recommended standard of 3,500 mg/L (Lawlor 2000).

3.5.8 Surface Water and Groundwater Rights

Due to the predominance of agriculture within the BNGPA, 8,468 water rights have been filed with the Montana Department of Natural Resources (2006) for both surface and groundwater for such uses as irrigation, dams, stock ponds, wildlife and waterfowl, reservoirs, domestic, and municipal uses. Seventy-one percent of the water rights filed within the project area are for stock (3,645 water rights filed) and irrigation (2,336 water rights filed). Irrigated agriculture is the largest use of water. Of the diverted water claims, approximately 10 percent are from groundwater sources, and 90 percent from surface water sources (DNRC 2006). Most irrigation water supply is from the Milk River and from Quaternary alluvium and glacial deposits and the Upper Cretaceous Judith River Formation. Water for domestic supplies is obtained from the Milk River, the alluvium and glacial deposits, and the Judith River Formation. Water for domestic supplies from these sources typically requires some form of treatment before use.

3.6 LIVESTOCK GRAZING

3.6.1 Range Resources

Livestock grazing is currently one of the principal economic uses of land in the project area. Grazing allotments are areas of land where individuals graze livestock. An allotment generally consists of federal rangelands, but may also include intermingled parcels of fee-lands or state lands. The BLM stipulates the type and number of livestock and period of use for each allotment.

An Animal Unit month (AUM) is the amount of forage needed by an ‘animal unit’ (AU) grazing for one month. The animal unit in turn is defined as one mature 1,000-pound cow and her suckling calf. Assuming that such a cow nursing her calf will consume 26 pounds of dry matter (DM) per day as forage. That consumption, combined with a factor for tramping and waste of about 25 percent, results in an estimate of about 1,000 pounds of dry matter (DM) from forage to supply one AU each month.

Recommended stocking rates are based upon results from grazing research, local experience, and clipped plot yields. Herbage production can be highly variable due to differences in range site topography, climate, exposure, level of the water table, and in the depth, texture, and salinity of the soil. The more productive range sites usually occur where soils are deeper and additional moisture is supplied either through overflow or sub-irrigation and are typically associated with riparian environments and valley floors. The less-productive soils are characterized as shallow if less than 20 inches deep or very shallow if less than 10 inches to a root-limiting layer such as bedrock. Although all parts of the environment have the potential to influence the vegetation on a site, precipitation probably is the single-most important factor (Fisser 1987).

3.7 RECREATION AND VISUAL RESOURCES

3.7.1 Recreation

Introduction

The BNGPA contains opportunities for hunting, fishing, pleasure driving (including off-highway vehicle rides) and wildlife observation. Boating, picnicking, and camping also occur in the project area.

BLM land in the BNGPA supports dispersed recreation. Site-specific resources are those of the BOR (Nelson Reservoir), the USFWS (parts of the Bowdoin National Wildlife Refuge complex), and the State of Montana (fishing access sites on the Milk River and Cole Ponds). Private lands throughout the area are accessible to hunting through non-commercial and commercial arrangements.

Montana residents are the main users of recreation resources in the BNGPA, with most resident users likely from northeastern Montana, coinciding with the Region 6 management division of the Montana Department of Fish, Wildlife and Parks. Out-of-state users include hunters, visitors passing through the area on their way to major destinations such as Glacier National Park or the Missouri River, and holders of recreation cabin site permits at Nelson Reservoir.

The Bitter Creek Wilderness Study Area (WSA) is located in the BLM Glasgow Field Station, outside of the BNGPA to the east. The western boundary of this WSA is never closer than approximately 10 miles from the eastern boundary of the project area.

Phillips and Valley Extensive Recreation Management Areas

Most BLM land in the BNGPA is within the Phillips Extensive Recreation Management Area (ERMA) located in northern Phillips County. The remainder of the BLM land in the BNGPA is contained in the Valley ERMA in northern Valley County. The Judith-Valley-Phillips RMP (1994) issued management directives for the Phillips and Valley ERMAs. BLM's management regime supports dispersed and unstructured recreation with minimal maintenance and no developed facilities.

Recreation use in the BNGPA appears to be moderate. The area may support some type of recreational activity throughout the year, with the heaviest use occurring during the fall hunting seasons. Hunting for upland birds, big game, and waterfowl occurs from August through December. Some small reservoirs scattered about the area are stocked for fishing though their primary use is for livestock (Collins 2006).

Land tenure is scattered among public and private interests, but owner-sanctioned access to private land is common so access is generally good for hunting and other recreation throughout the BNGPA (Collins 2006).

Off-highway vehicle (OHV) use on BLM lands in the Malta Field Office is primarily associated with other activities such as hunting, fishing, and driving for pleasure. The highest concentration of OHV use occurs during fall hunting season (BLM 1992). Public cross-country travel (off-road travel) is prohibited year-round as per the OHV EIS Proposed Plan Amendment for Montana, North Dakota and South Dakota, June 2003 Record of Decision. All public motorized wheeled-vehicle travel is restricted to existing roads and trails within the BNGPA and the Malta Field Office boundary. The ROD limits travel for administrative use by the BLM, other government entities, and lessees and permittees, but allows motorized wheeled cross-country travel when

necessary. The exemption in the ROD for necessary cross-country travel by oil and gas lessees states, “Motorized wheeled cross-country travel for lessees and permittees is limited to the administration of a federal lease or permit. Persons or corporations having such a permit or lease could perform administrative functions on public lands within the scope of the permit or lease; however, this would not preclude modifying permits or leases to limit motorized wheeled cross-country travel during further site-specific analysis to meet resource management objectives or standards and guidelines” (BLM 2003). The Malta Field Office considers this exemption when regulatory and environmental compliance work is undertaken pursuant to existing statutes and regulations.

Fishing-Based Recreation Areas

Nelson Reservoir is located in the southeast corner of the project area on U.S. 2 near Saco, Montana. The reservoir has 4,320 surface acres and 30 miles of shoreline. The reservoir and recreation sites are managed by the BOR Montana Area Office in Billings. Developed facilities operated by the BOR include a concrete boat ramp, campground, and picnic shelters. Nelson Reservoir contains a walleye, yellow perch, and northern pike fishery managed by the Montana FWP, with the private organization Walleye Unlimited also involved in funding for stocking of the reservoir. There are also black crappie and possibly other sport fish species in Nelson Reservoir.

The BOR issues permits, or leases, to construct and maintain recreation cabins on sites in designated areas on the Nelson Reservoir shoreline. There are now 106 cabin-site leaseholders, about one-third from outside Montana. All permit holders are members of the Nelson Reservoir Recreation Association, which represents their interests to the BOR (Anderson 2006).

Leaseholders are allowed to construct and own site improvements, which may include a single family dwelling for seasonal use, water and sanitation systems, boat docks, retaining walls, and access routes (Frasure 2006). The cabin sites are generally used on weekends and for longer stays during the fall hunting season. In the last five years a number of new improvements have been built by lessees, more permits have been transferred from one holder to another, and the BOR has received more inquiries about availability of sites than in the past, indicating a rising trend of interest in the cabin site area at Nelson Reservoir (Anderson 2006, Frasure 2006).

BOR lands surrounding Nelson Reservoir contain existing natural gas wells, with two wells next to recreation cabin sites and one well on a cabin site (Frasure 2006). Gas wells and recreation cabins have coexisted for sometime near the Nelson Reservoir area, with wells predating many recreation improvements, according to the Nelson Reservoir Recreation Association; no issues or conflicts between cabin owners and natural-gas development have been reported (Anderson 2006, Frasure 2006). There are also grazing leases on BOR land that surrounds the designated recreation area; the leases are managed by the Malta Irrigation District under contract to the BOR (Frasure 2006).

Other sport fisheries in the BNGPA are the Milk River and five small reservoirs that are stocked by Montana FWP. Montana FWP maintains Fishing Access Sites (FAS) at two of these resources. They are the Bjornberg Bridge FAS, seven miles east of Saco on the river bank (toilet) and the Cole Ponds FAS, 10 miles northwest of Saco (primitive campsite and toilet). Compton Reservoir, PR 22, and PR 54 are stocked for fishing, and found at scattered locations in the northern part of the BNGPA within 10 miles of the Canadian border.

Bowdoin National Wildlife Refuge Complex

Six units of the Bowdoin National Wildlife Refuge (NWR) complex are inside the BNGPA. These are Hewitt Lake NWR, a satellite refuge, and five small waterfowl production areas (WPAs). The 15,550-acre Bowdoin NWR itself is adjacent to the BNGPA but outside the project area. The USFWS owns the five WPAs in the BNGPA for a total of 5,566 acres (Graham 2006). The Hewitt Lake NWR area is 1,680 total acres, composed of 720 acres of Public Domain and 960 acres of easement land (USFWS undated).

Recreation Activities and Use

Hunting, fishing and wildlife observation are primary motivations for recreation visits to the BNGPA. Other recreation activities may be the main reason for a visit but more often they are part of a visit made primarily for hunting, fishing, or wildlife watching (Collins 2006).

The BLM estimates recreation visits for its recreation areas overall but not for smaller sub-areas, so the number of recreation visits is not known for the Phillips and Valley ERMAs, which contain the BNGPA. Based on trends for lands under BLM management, recreation use is likely to be on the increase within the BNGPA since the 1992 JVP predicted a two percent annual increase (BLM 1992).

Among the non-resident tourists and recreation visitors to Montana are many who use BLM lands for recreation. The State of Montana tracks visitor spending for multi-county regions but not for single counties or smaller areas, so total visitor numbers are not available for the BNGPA (BLM 1992). Total visitors to the state include non-resident hunters. Estimates are found below of how many non-resident hunters use the hunt districts that overlap the BNGPA though not specifically for the project area itself.

Hunting. Hunter use data specifically for the BNGPA are not available. Estimates of hunter use are available for Montana FWP Hunt Districts (big game) or for counties (upland game birds). The hunter activity estimates presented below were compiled from the 2003 Deer Hunting Report (Montana FWP 2004*a*), the 2003 Pronghorn Antelope Hunting and Harvest Report (Montana FWP 2004*b*), and the 2003 Upland Game Bird Hunting and Harvest Report (Montana FWP 2004*c*).

In 2003 the four hunt districts that overlap the BNGPA drew a total of 5,125 mule or whitetail deer hunters and 2,016 antelope hunters. Twenty-six percent of the deer hunters and 12 percent of the antelope hunters were non-residents. The deer season generated 21,836 hunter days of activity (4.3 days per hunter) and the antelope season generated 6,721 hunter days (3.3 days per hunter). Whitetail deer hunting is generally concentrated in riparian and agricultural habitats along the Milk River from Malta east to Glasgow.

The 2003 upland game bird season attracted 3,524 hunters to Phillips and Valley counties for a total of 30,276 hunter days of activity, or an average 8.6 days per hunter. Thirty-nine percent of upland game bird hunters were non-residents of Montana.

The only estimates of area waterfowl hunters are for the Bowdoin NWR, which is outside the BNGPA. However, the Hewitt Lake NWR and USFWS WPAs within the project area are also known as places for waterfowl hunts. In 2005, the Bowdoin NWR drew 150 Montana resident waterfowl hunters and 185 non-residents from 25 states and Canada. The site also attracts upland bird hunters—in 2005, 603 residents and 313 non-residents representing 28 states and Canada (Graham 2006). A small part of the Bowdoin NWR hunter data could come from the USFWS Pearce WPA directly north of Bowdoin NWR. It is managed by Bowdoin NWR but is

located within the BNGPA. Some hunters probably hunt on Pearce WPA and Bowdoin NWR in the same day and report combined harvest information for both at the hunter check station at Bowdoin NWR.

Phillips County is also known for winter coyote and rabbit hunting.

Fishing. Fishing pressure at Nelson Reservoir was 12,558 days fished in 2003, ranking it third in Montana Fish, Wildlife and Parks Region 6, which covers northeastern Montana (Montana FWP 2006*a*). Fishing pressure on the Milk River from Hinsdale to Malta, which is mostly in the BNGPA, was 1,595 days fished in 2003, for a regional rank of 13 (Montana FWP 1006*b*). Cole Ponds had 28 days fished in 1999 (last published data), a regional rank of 102 (Montana FWP 2006*c*). No data are published for other small reservoirs in the BNGPA.

Wildlife Observation. Wildlife observation in the BNGPA generally occurs as scouting for hunting. However, northeastern Montana attracts wildlife observation not connected to hunting, and bird watching is promoted in a brochure published by the regional tourism agency using accommodations tax funds (Northeastern Montana Birding Trail 2005). The route identified in the brochure follows U.S. 2 from Malta to Hinsdale through the BNGPA. The only specific viewing site identified by the brochure near the project area is the Bowdoin NWR, which is outside the BNGPA.

3.7.2 Visual Resources

Extent and Location of VRM Classified Lands

BLM-administered land in the BNGPA is in visual resource management (VRM) Classes II, III, and IV (BLM-LDO 1994a; BLM-LDO 1994*b*). Table 3.7-1 summarizes acreage by VRM Class. The lower the class number, the greater the management objective to minimize the introduction of contrast to the characteristic landscape from incompatible elements of form, line, color, and texture.

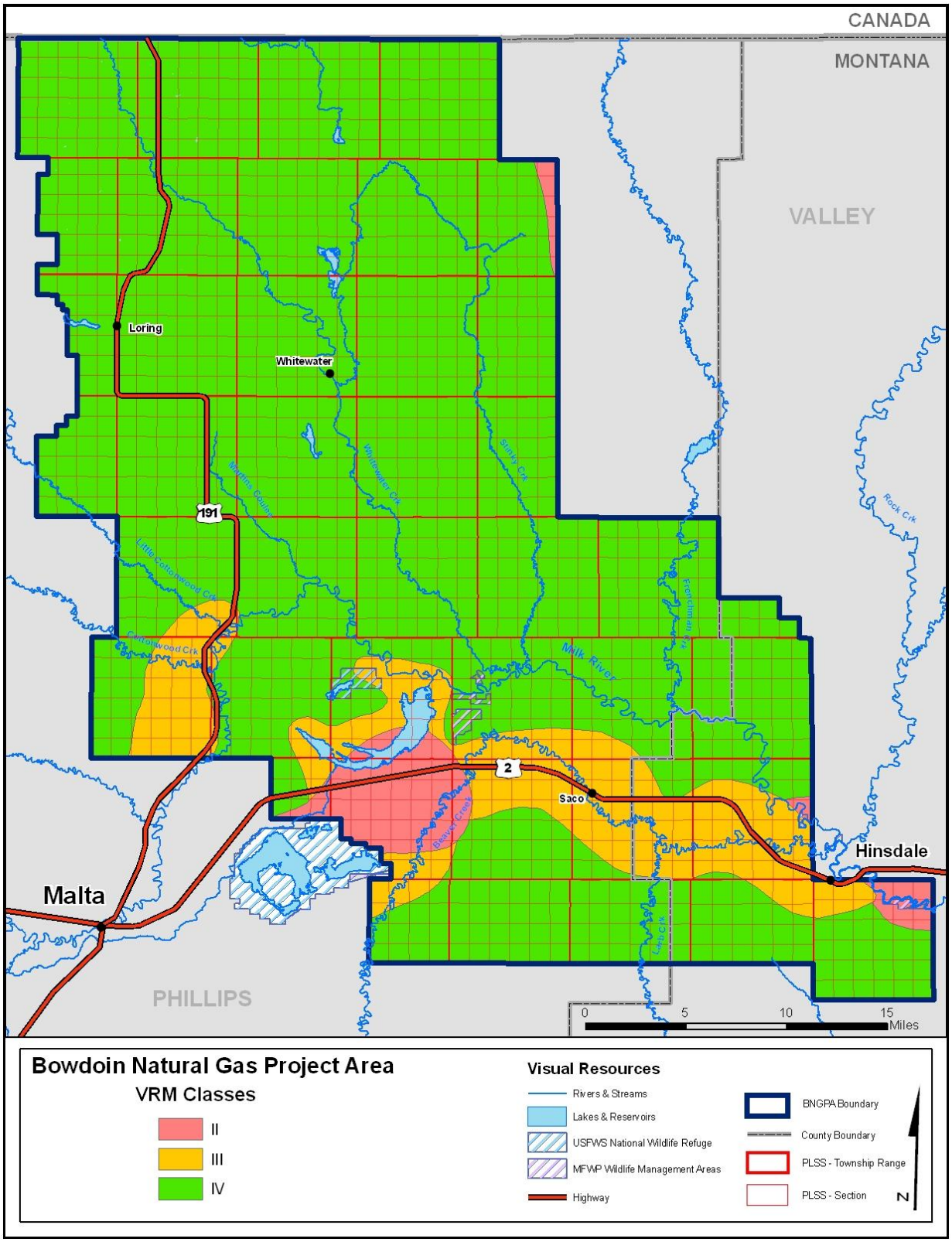
Table 3.7-1. BLM Lands in the BNGPA by VRM Class

VRM Classification	Acreage
Class II	31,191
Class III	94,385
Class IV	686,812

Source: Acreage calculated by GIS software from digital data (VRM_b.shp) obtained from BLM Malta Field Office, May 18, 2006.

Potentially affected areas with the highest level of visual resource protection are found in the southern part of the BNGPA. Most Class II and Class III landscape is associated with Nelson Reservoir, selected reaches of the Milk River, and parts of the tributary Little Cottonwood and Beaver creeks. The western edge of a block of Class II landscape associated with the Frenchman Creek drainage, found to the east of the BNGPA, just extends into the upper northeastern part of the BNGPA. Figure 3.7-1 illustrates the distribution of BLM lands by VRM class in the BNGPA.

Figure 3.7-1. BLM Lands by VRM Class in the BNGPA



Source: Map prepared from digital data (VRM_b.shp) obtained from BLM Malta Field Office, May 18, 2006. Original data from BLM-MSO 1992, Map 1.

Scattered, irregular blocks of BLM land categorized as VRM Class II landscape lie on the north and south shore of Nelson Reservoir in the southwestern part of the BNGPA and extend south from the reservoir to Beaver Creek. Several scattered parcels of VRM Class II landscape are associated with the Milk River between Hinsdale and Vandalia. Some of the VRM Class II viewshed associated with the Frenchman Creek drainage spills over into the northeastern part of the BNGPA.

VRM Class III landscape is located on irregular blocks of land north of Nelson Reservoir, and along Little Cottonwood Creek west of Hewitt Lake NWR. VRM Class III landscape is also found in irregular blocks scattered along the Milk River from the western to the eastern boundary of the BNGPA. Other BLM-managed landscapes within the BNGPA are rated as VRM Class IV.

Characteristic Landscapes

VRM Class IV landscapes within the BNGPA are generally broad, open prairie grasslands. Their similarity and frequent occurrence lead to a lower rating in terms of scenic quality. These areas have views of uniform vegetation, simple skylines, and open skies that create the appearance of relatively unbroken, horizontal bands and lines. Class III lands in the BNGPA are similar in appearance to Class IV lands; however, they are distinguished by being adjacent to and visible from the Class II lands of the project area. Class II areas in the BNGPA are scattered, smaller blocks of BLM landscape that offer a pleasing contrast to the uniformity of the plains because they contain the Milk River, tributary streams, or lakes and reservoirs as described in section **3.7.1**, **Recreation**.

Landscape Viewers

Recreational users may be sensitive to adverse contrast in the higher-rated landscapes of the BNGPA. As noted in Section 3.7.1, these would be Nelson Reservoir; the Milk River riparian area; Montana Fish, Wildlife and Parks Fishing Access Sites (FAS); and the six waterfowl-oriented units of the NWR complex that are located within the BNGPA. As also noted in Section 3.9.1, potential viewers may include participants in hunting, fishing, camping, picnicking, pleasure driving (sightseeing), and wildlife observation (e.g., birding). The scenery found at these locations provides the backdrop for local recreation activity.

Management Directives

A landscape's VRM class sets the BLM's management objectives for allowable change in the area's appearance. These are stated as levels of adverse contrast that a new BLM activity can introduce to the landscape. Adverse contrast occurs when the new elements do not repeat or harmonize with the characteristic form, line, color, and texture of the natural landscape.

In VRM Class II areas, which are relatively sensitive areas found in parts of the BNGPA, the management objective is to retain the existing character of the landscape. The level of change should be low. New activities may be seen but should not attract the attention of the casual observer. Changes *must* be designed to repeat naturally appearing form, line, color and texture.

In VRM Class III areas, which are found near rivers, streams and reservoirs in the southern part of the project area, the objective is to partially retain the existing character of the landscape by allowing moderate change. Moderate change may attract attention but not dominate the view of the casual observer. Change *should* be designed to repeat naturally appearing form, line, color and texture.

VRM Class IV areas are the most common BLM lands in the BNGPA. These are designated specifically for activities that require major modification of the existing character of the landscape. A new activity can create a high level of change to a Class IV landscape and may even dominate the view. However, BLM's management objective for these areas does call for every attempt to be made to use careful location, minimization of disturbance, and characteristic design elements to help offset the visual impact of a new activity.

In approved management plans for the Phillips and Valley RAs, BLM noted increased interest in tourism and sightseeing activity and, because of it, placed management emphasis on maintaining scenic quality within VRM Class II areas within the overall multiple-use management direction. For Class III and IV areas, BLM noted that management allows alteration of the visual landscape but works to minimize the visual disruption. To implement the objectives, BLM stated that surface developments will be designed or mitigated to complement and harmonize with natural features and the VRM class objectives. Visual contrast rating will be used as a guide for major projects proposed on VRM Class I, II, and III lands. The VRM class objectives may not always be met due to non-discretionary actions or exceptions that may occur after evaluation and at the discretion of the authorized officer (BLM-LDO 1994*a*; BLM-LDO 1994*b*).

Surface restrictions affecting the location of mineral exploration and development with respect to visually sensitive resources such as recreation development may also apply to mineral tracts located within the boundary of a BOR project where the United States owns 100 percent of the fee mineral interest. These restrictions may be included as stipulations at the request of BOR in leases issued by the BLM for activity on BOR surface (Stiles 2006).

3.8 SOCIOECONOMICS

The study area for assessment of potential effects of the Proposed Action and alternatives on social and economic conditions includes northern Phillips County and western Valley County. These rural, north-central Montana counties are bordered by the Missouri River/Fort Peck Lake on the south and the Canadian border on the north. The project area is located north/northeast of Malta, the county seat for Phillips County and northwest of Glasgow, the Valley County seat. In Phillips County, the town of Saco and the settlements of Loring and Whitewater are located within the BNGPA, as are the Valley County settlements of Hinsdale and Beaverton (see Figure 1.1-1, General Location Map).

Economic and population trends were identified by running and reviewing the Sonoran Institute/BLM's *Economic Profile System* for Phillips and Valley counties, which are available online at: http://sonoran.org/index.php?option=com_content&task=view&id=70&Itemid=188. This information was augmented with data from a variety of other federal, state and local sources, as cited in the text.

The cultural and social setting of the area including Native American occupation and use of the land and the post-European settlement history is discussed in section **3.2, Cultural Resources**.

During the last century, ranching, farming, mining, natural-gas development, the railroad and, in Valley County, construction of the Fort Peck Dam and the establishment and subsequent closure of Glasgow Air Force Base have all been important factors in the social and economic history of the area. More recently, outdoor recreation and tourism have been increasingly

important contributors to the local economies. Long-term socioeconomic trends in both counties are also characterized by gradual population loss.

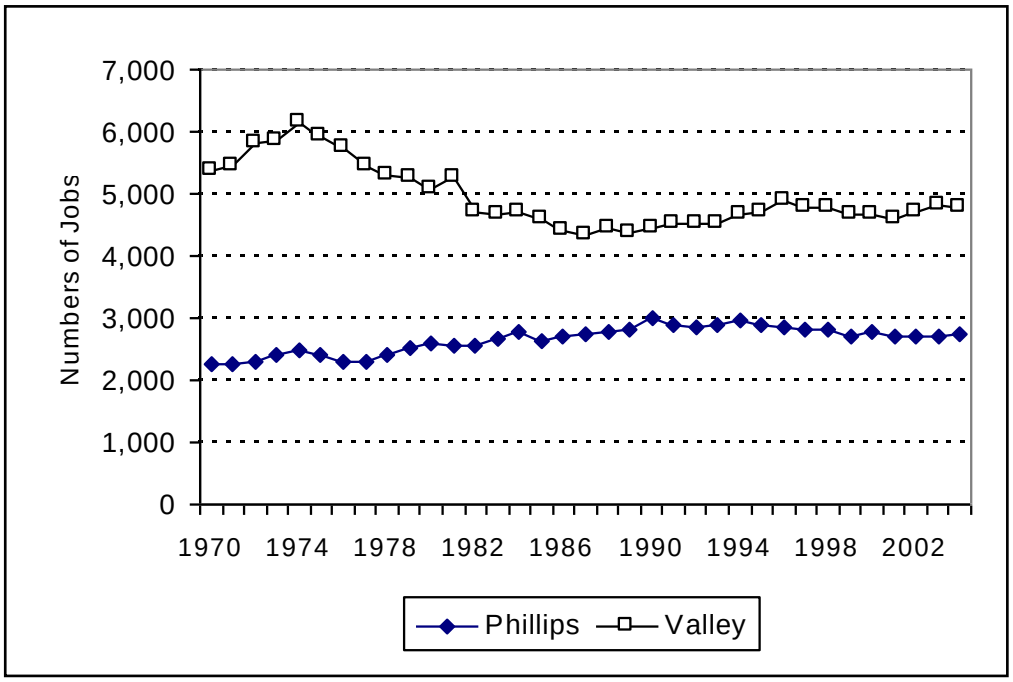
3.8.1 Regional Economy

Phillips and Valley counties share an economic heritage with other areas of the northern Great Plains, one in which agriculture played the dominant role in the region's initial post-European settlement and economic expansion. The development of the railroad across northern Montana in the late 1880s and the subsequent opening of the area to homesteading in the early 20th century ushered in an era of accelerated European settlement. Agriculture and other natural resource production helped spur the development of additional transportation infrastructure and the emergence of Malta and Glasgow as regional trade and service centers for north-central Montana. In more recent times, the establishment and subsequent closure of Glasgow Air Force Base, and federal water and wildlife management projects and programs have played pivotal roles in the region's economic development. Mineral and energy resource development, primarily in the form of mining and natural gas, have also shaped the area's economic history. The mining, oil and natural gas industries have also been important contributors to the regional economic base through their fiscal support for local government and education.

Employment

Over the past three decades, the Phillips and Valley county economies have experienced volatility associated with military base realignment and development and closure of a mining operation. In Valley County, employment rose dramatically in the early 1970s due to the reactivation of Glasgow AFB, peaking at 6,139 jobs in 1974. Beginning with the base's closure, total employment experienced a protracted decline, eventually falling by more than 1,800 jobs through 1987 (Figure 3.8-1). Losses in the agriculture sector also contributed to those declines. Employment trends since then are characterized by steady increases through 1996, followed by another cycle of modest contraction and expansion. Total employment stood at 4,779 jobs in 2004.

Figure 3.8-1. Total Full and Part-Time Employment, 1970–2004



Source: U.S. Department of Commerce, Bureau of Economic Analysis. 2006

The Phillips County economy, generally characterized by modest long-term growth since 1970, has experienced some volatility associated with precious-metal mining. Since 1970, total employment in Phillips County climbed from 2,263 jobs to a peak of 2,985 jobs in 1990. Post-1990, the local economy has experienced some contraction, with total employment falling to 2,712 jobs in 2001. In 2004, total employment in Phillips County was 2,745 jobs.

From the late 1970s thru the mid-1990s, gold mining was a major employer in Phillips County. Activity at the Zortman Landusky gold mine raised total mining employment to an estimated 350 jobs, about 12 percent of total employment. Current employment in mining is not reported due to confidentiality restrictions; however, industry sources estimate that there are around 50 direct mining jobs in the county; the large majority of those are associated with natural-gas development and production. In Valley County, jobs in mining have not exceeded two percent of the total within the past four decades.

The current composition of the local economies, in terms of employment, is evident in Table 3.8-1 below. Agriculture continues to be an economic cornerstone for the region, with more than 1,400 proprietors and employees in the two counties. Trade, hospitality services, health care, education, and public-sector employment are also important economic sectors in the region.

Table 3.8-1. Full and Part-Time Employment, by Selected Industrial Clusters, 2004

Employment	PHILLIPS COUNTY		VALLEY COUNTY	
	Number	% of Total	Number	% of Total
Farm employment	623	23%	823	17%
Mining	< 50 *	< 2%	41	1%
Construction, Manufacturing, Utilities, & Transportation	271	10%	513	11%
Wholesale & Retail Trade	387	14%	638	13%
Information, Finance and Insurance, & Real Estate	175	6%	334	7%
Hospitality — Arts, Entertainment, Recreation, Accommodations & Food Services	207	8%	418	9%
Other, including health care	587 to 637 *	20% to 22%	2,012	42%
Government	445	16%	803	17%
Total Employment	2,745	100%	4,779	100%

* Not reported due to confidentiality disclosure guidelines. The potential upper range of employment is determined from other data sources. The disclosure issues also affect reported employment in "Other" as well.
Source: U.S. Department of Commerce, Bureau of Economic Analysis, 2006

Agriculture. As with other industries, the federal government conducts an economic census of agriculture every five years. Results of the 2002 census are the most current available. A total of 1,268 Phillips and Valley county farms and ranches were recorded in the 2002 Census of Agriculture (Table 3.8-2). These operations involved more than 3.9 million acres, equivalent to approximately 60 percent of the combined land area of the two counties. In 2002, local farms and ranches reported total sales of $105.2 million in agricultural products. Livestock sales were the primary source of agricultural revenue in Phillips County, with crops the primary source of sales in Valley County. Despite the large receipts from sales, farmers and ranchers in Phillips County recorded an aggregate negative net income of $1.2 million in 2002. Farmers and ranchers in Valley County fared better, recording an aggregate income of $13.5 million.

Table 3.8-2. Overview of Local Agriculture, 2002

	Phillips County	Valley County
Number of farms	525	743
Land area in farms (acres)	1,896,941	2,051,667
Farm land – percent of county area	57.7	65.1
Market value of agricultural products sold	$37.81 M	$67.44 M
• Crops	$12.14 M	$32.39 M
• Livestock	$26.67 M	$35.05 M
Farm Operators with farming as a principal occupation	376	542
Total farm labor and proprietor's Income	($1.2) M	$13.5 M

M = Millions

Source: U.S. Department of Agriculture, 2004 and U.S. Department of Commerce, Bureau of Economic Analysis, 2006.

Minerals. Mining sector activity in the study area has included gold mining in Phillips County, oil production in Valley County and natural gas production and bentonite mining in both counties.

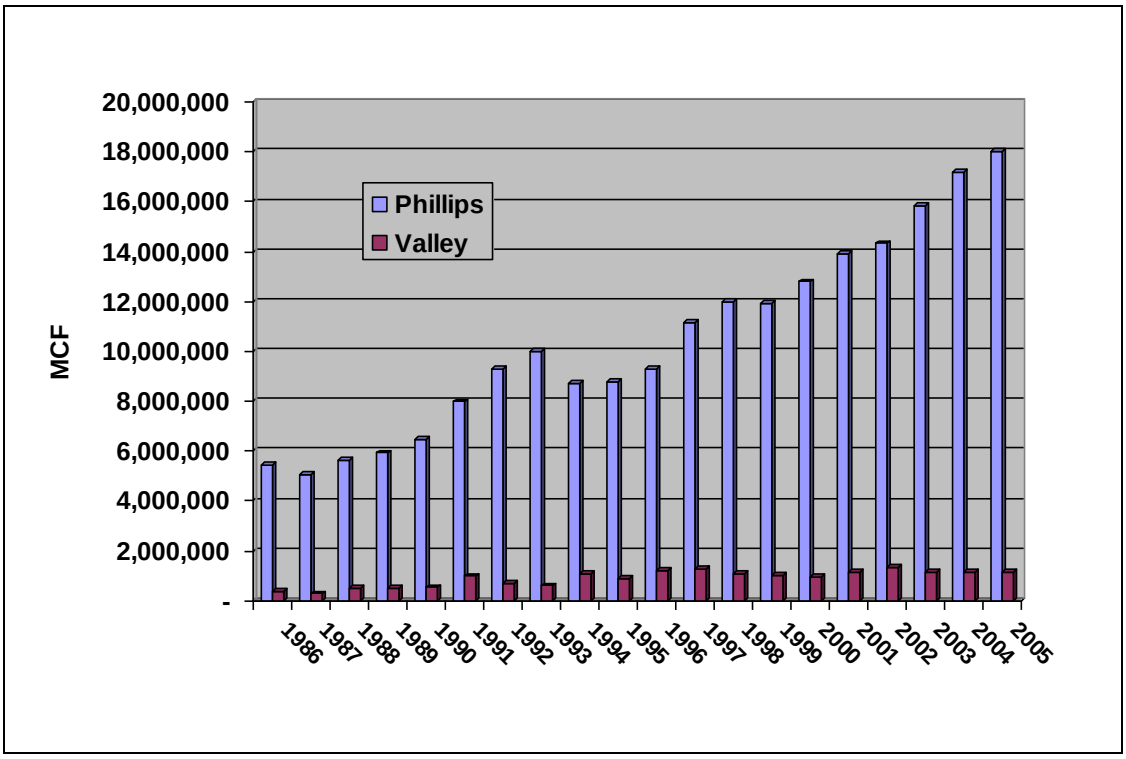
Gold mining once provided a major economic stimulus in the region. As described in the BLM's Judith Valley Phillips RMP, gold-mining activities in the Little Rocky Mountains, south and west of the BNGPA, have waxed and waned for over 100 years. Since the closure of the Zortman-Landusky mine in the mid-1990s, the few remaining jobs related to gold mining have been associated with the environmental reclamation and restoration of the mine. Jobs in oil and natural gas development and production account for most of the direct employment reported in the mining sector. In addition, local oil and gas production supports jobs in the natural gas pipeline transmission industry. According to a national database of businesses, a total of seven natural gas firms with a combined total of 64 employees presently have offices in Phillips and Valley counties. These firms are supported by field-service firms from regional oil and gas centers such as Casper, Wyoming; Havre, Montana; and the Williston Basin of North Dakota. These firms deploy staff and equipment to the region as needed (Dun & Bradstreet 2006, Bowman 2006). A variety of local contractors, primarily in the service and construction sectors, also provide contract services to the Bowdoin-area gas fields.

Natural gas production in Phillips County ranked first in the state in 2005, with over 18 Bcf gas produced. Natural gas production from Valley County, although substantially lower (1.15 Bcf), nonetheless ranked sixth in the state.

BLM manages 54 percent of minerals in Phillips County and 43 percent in Valley County. In FY 2006, payments from the U.S. Minerals Management Service related to mineral royalties from production of federal minerals on public domain managed by the BLM were $1.1 million to Phillips County and $100,169 to Valley County (Montana Department of Revenue, 2006). In addition, payments from minerals leasing, oil and gas bonuses, oil and gas pipeline right-of-way, and oil and gas royalties from Bankhead Jones (aka Land Utilization Project) lands administered by the BLM were $222,549 for Phillips County and $52,502 for Valley County (BLM, 10/25/06)

Annual gas production for Phillips and Valley counties from 1986 through 2005 is shown in Figure 3.8-2. Production has been on a general upward trend in both counties: annual gas production increased 236 percent in Phillips County and 207 percent in Valley County over the 20-year period, although Valley County reached its 20-year peak in 2002 at 1.35 Bcf.

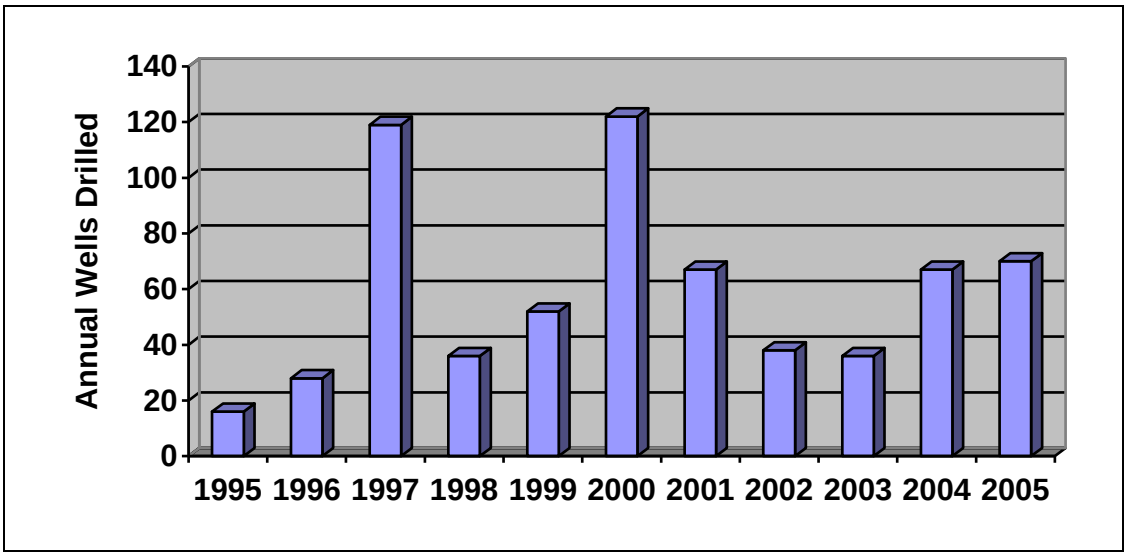
Figure 3.8-2. Annual Natural Gas Production, Philips and Valley Counties: 1986–2005



Source: MBOG 2006

Annual drilling levels in the BNGPA have varied substantially over the last 10 years, as shown in Figure 3.8-3. Annual drilling levels ranged from 16 wells in 1995 to 122 in 2000.

Figure 3.8-3. Bowdoin Gas Field Annual Drilling Levels 1995–2005



Source: Bowdoin Operators 2006

Over the past 10 years the annual drilling program in the Bowdoin field has been accomplished with one or two drilling rigs operating in the field at any given time (Bowman 2006, Divestco 2006).

The Montana Board of Oil and Gas reports there were 1,459 producing wells in fields within the BNGPA during 2005 and that a total of 382 wells were drilled in Phillips County between 2000 and 2005. Of that total, 99.7 percent were productive and one well (or less than 0.3 percent of total wells drilled) was unproductive. A total of 27 wells were drilled during this period in Valley County, resulting in 7 producing oil wells, 14 producing gas wells and 6 dry holes. A total of 77.8 percent of all Valley County wells drilled during this period were productive and 22.2 percent were unproductive.

The costs for developing a well in the BNGPA can run between $100,000 and $300,000 including lease acquisition, surveying, cultural/biological clearance, site preparation, drilling, completion, surface facility and gathering-system installation. Well production costs can run upwards of $200 per well per month, depending on the Operator and the location of the well within the BNGPA.

Drilling in the BNGPA normally occurs during the July through November period. When the winters are mild, drilling also occurs during the winter. Drilling rarely occurs during the spring due to muddy road conditions. Natural gas wells in the Bowdoin area can typically be drilled in 36 to 40 hours. Cased-hole logging of the well requires another day. In the recent past, several Bowdoin Operators have contracted with the same drilling company (recently a Casper, Wyoming-based company) to drill all Bowdoin-area wells in a particular drilling season. The drilling contractor transports a rig and crew to the Bowdoin area and drills continuously until all wells are completed. The rig then moves on to its next assignment. Consequently, only one or two rigs are typically in operation in the Bowdoin area at any one time (Bowman 2006).

The temporary drilling workforce typically includes 15 drilling-related workers, four workers involved in cementing the well, and a 3-person cased-hole logging crew.

Similarly, one completion crew (14 workers) typically travels to the Bowdoin area to complete all wells drilled during one drilling season. Bowdoin-area wells are typically completed for one to five zones. Although it requires approximately 11 days to complete a zone, activity typically occurs on-site during four days and in some cases for only a matter of hours during those four days.

One crew (10 to 15 workers) also typically installs gathering lines for all Bowdoin-area wells drilled in one drilling season.

Up to four compressor stations will also be built during the 15-year development period assumed for this assessment. Compressor station construction would require a relatively small number of construction workers for a several-month period.

Drilling, completion, gathering system/field infrastructure construction crews are generally non-local, locating to the BNGPA for the duration of their task. Some crews hire a few local workers, but non-locals require temporary lodging in motels or recreational vehicle parks for the duration of their stay. Additional jobs are generated in the lodging, food service, entertainment, and automotive services sectors of the local economy.

Field operations employment includes fieldmen, water haulers, and pipeline and compressor facility operations and maintenance personnel. Fieldmen or pumpers maintain wells (each fieldman visits an average of 10 to 12 wells a day; each well is typically visited on a schedule ranging from twice a week to once every two weeks). Fieldmen can be either company or contract employees. Water haulers are typically contract employees. Additionally, a variety of local contractors in the natural gas service and construction industries are employed on an intermittent basis.

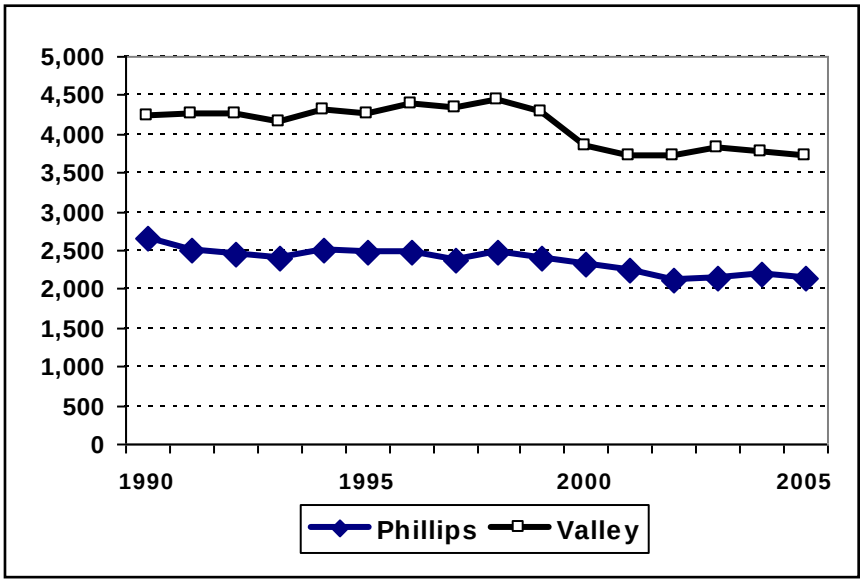
Tourism and Recreation. Recreation resources and use are described in section **3.7.1**, **Recreation**. Most tourism and recreation visits to the area are outdoor recreation-oriented, associated with hunting, fishing, boating, wildlife-watching or sightseeing. Major attractions include the Charles M. Russell and Bowdoin National Wildlife Refuges and Nelson and Fort Peck reservoirs. The Phillips County Museum, Sleeping Buffalo Resort, and other attractions also draw tourists from Montana and elsewhere. The Judith Valley Dinosaur Institute organizes fossil digs which are a growing source of visitors to the area. The Fort Peck Theater provides plays and a performing-arts camp. Events like county fairs and the Montana Governor's Cup Walleye Tournament also attract visitors.

Labor Market Conditions

Long-term population declines, coupled with the general aging of the population and regional economic contractions, are reflected in the local labor market conditions. The local pool of individuals employed or actively seeking work has decreased by nearly 20 percent in Phillips County since 1990, as the labor force declined to 2,127 in 2005. Much of the change is the result of population out-migration triggered by layoffs and ultimate closure of the Zortman Landusky mine in the mid-1990s.

Valley County's labor force has fluctuated within a relatively small range of 4,200 to 4,400 individuals through much of the 1990s. Out-migration of former residents in the late 1990s and reassessments in the wake of the 2000 Census revealed a sharp decline in the labor force, 3,848 in 2000 compared to 4,430 in 1998. Since 2000, the labor force has experienced a cyclical period of decline, modest growth, and another decline (Figure 3.8-4).

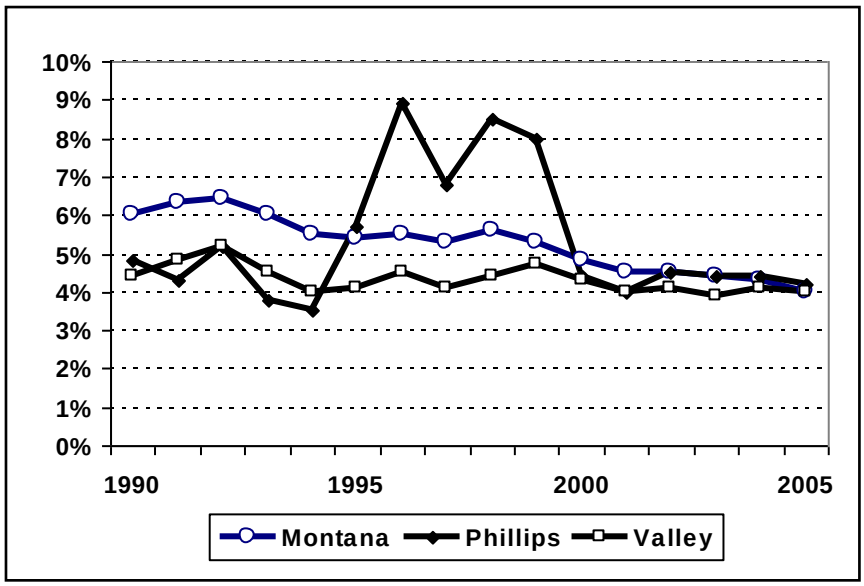
Figure 3.8-4. Phillips and Valley County Labor Force Trends, 1990–2005



Source: U.S. Department of Labor, 2006

Except during periods of relatively dramatic economic dislocation, such as the closure of the Zortman Landusky mine, unemployment in the region since 1990 has generally been between 3.5 and 5.0 percent, below the statewide average (Figure 3.8-5 below). Migration plays a significant role in maintaining unemployment rates below the statewide norms. Estimates for the U.S. Census Bureau indicate a net outflow of 360 residents from Phillips County between 2000 and 2005 and a net outflow of 446 residents from Valley County during the same period. (U.S. Census Bureau, 2006.)

Figure 3.8-5. Trends in Phillips & Valley County Unemployment Rates: 1990–2005



Source: U.S. Department of Labor, 2006

Labor markets are presently relatively tight in both counties. In May 2006, unemployment in Phillips County was at 76 individuals, 3.5 percent of the labor force. In Valley County, unemployment during the same period was 120 persons, equal to 3.3 percent of the labor force. (U.S. Department of Labor 2006)

Personal Income

Residents of Phillips County had total personal income of $100.36 million in 2004. The total personal income of Valley County's residents was $224.88 million. Wages, salaries, and proprietors' income accounted for the majority of total income in both counties, although non-labor earnings, such as dividends, nearly matched labor earnings in Phillips County. Positive net-residency adjustments, gained by local residents who work outside the county, were recorded in both counties (Table 3.8-10). Personal current transfer receipts are a significant source of income in the region, accounting for 23 percent of all income in Phillips and 19 percent of income in Valley County.

Table 3.8-3. Personal Income, Phillips and Valley Counties, 2004

	Phillips County	Valley County
Derivation of Personal Income:		
Earnings by Place of Work	$ 54.29 M	$ 136.39 M
Net Earnings Adjustment for Residency [1]	1.40 M	3.42 M
Dividends, Interest and Rent	27.95 M	57.27 M
Personal Current Transfer Receipts [2]	23.24 M	42.98 M
Contributions for Social Insurance	(6.52) M	(15.18) M
Total Personal Income	$ 100.36 M	$ 224.88 M
Per-Capita Personal Income (PCPI)	$ 23,670	$ 31,048
Montana Statewide PCPI	$ 27,567	$ 27,567
Local PCPI / Statewide PCPI	86%	113%

M = Millions

[1] The adjustment for residence is the net inflow of earnings of local residents commuting to jobs in other counties, less earnings paid by local firms to workers commuting to work from residences in other counties.

[2] Personal current transfer receipts are benefits received for which no current services are performed. Examples include unemployment, retirement and disability benefits, Medicare, and public medical and income maintenance benefits. Pensions and annuities for private and government employee retirement plans are not included.

Source: U.S. Department of Commerce, Bureau of Economic Analysis. 2006.

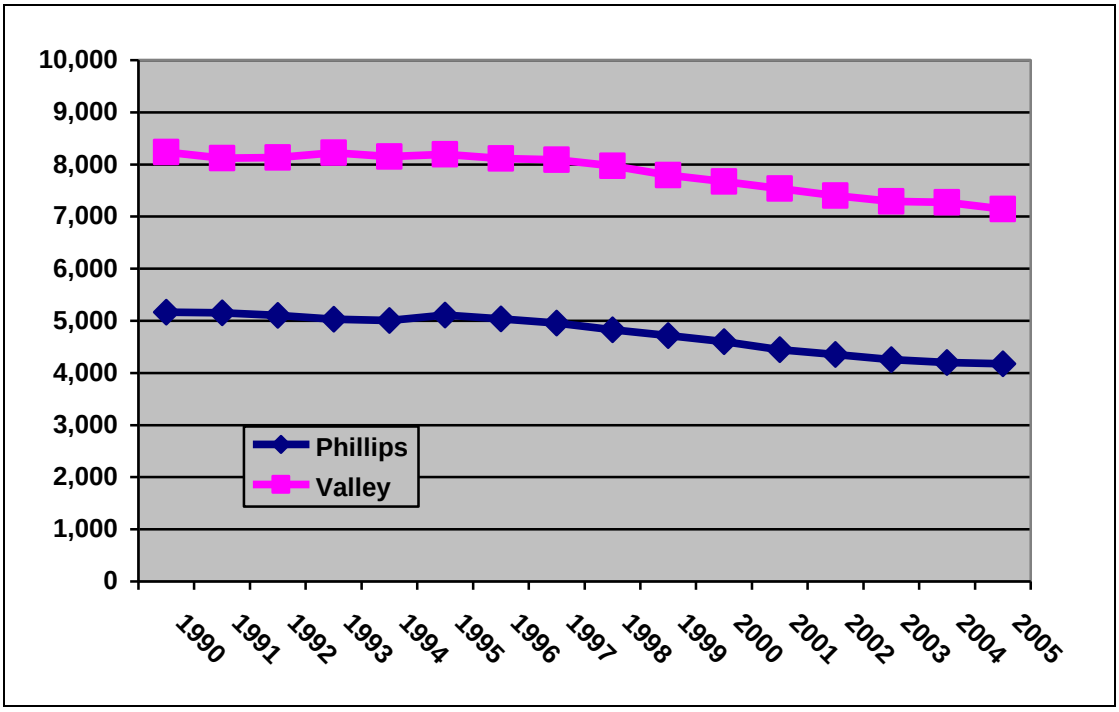
When viewed on a per-capita basis, Phillips County residents lagged behind the statewide average by a considerable margin—nearly $4,000 in 2004—extending a three-decade-long pattern. That relationship contrasts with that in Valley County where residents had an average income of $31,048 per capita, about $3,500 above the statewide average. Per-capita income in both counties was below the national average of $33,050 in 2004. The income disparities are also apparent in the 1999 median household income, which accounts for differences in household size: $28,702 in Phillips, $30,979 in Valley, and $33,024 statewide, compared to $41,994 for the nation as a whole.

3.8.2 Population

Both Phillips and Valley counties have been losing population for some time. Phillips County population declined from 9,311 in 1920 to 4,601 in 2000, a 50 percent decline over 80 years. Valley County reached its peak decennial population of 17,080 in 1960 and then declined to 7,675 in 2000 a loss of 9,405 or 55 percent over 40 years.

Figure 3.8-6 displays the total populations of Phillips and Valley counties from 1990 through 2004; between 1990 and 2005, Phillips County declined by 984 persons or 19 percent and Valley County declined by 1,096 persons or 13 percent. In contrast, the statewide population of Montana grew by 17 percent between 1990 and 2005.

Figure 3.8-6. Phillips and Valley County Population: 1990–2005



Sources: Population Division, U.S. Census Bureau. 1990–1999: Release Data: April 17, 2002; 2000 to 2004, Release Data: June 30, 2005

Population in local communities also declined during the 1990–2004 period. As shown in Table 3.8-4, community population declines ranged from a high of 28.6 percent in Fort Peck in Valley County to a low of 9.4 percent in the Phillips County town of Saco, home to a number of gas field and pipeline employees. Unincorporated areas of both counties also lost population; Phillips County areas outside of incorporated communities fell by 19.7 percent between 1990 and 2004, while Valley County unincorporated areas fell by 7.3 percent.

Table 3.8-4. Population in Phillips and Valley County and Communities: 1990, 2000 and 2004

County/Community	1990	2000	2004	% Change: 1990-2004
Phillips County	5,163	4,601	4,201	-18.6
Dodson	137	122	111	-19.0
Malta	2,340	2,120	1,940	-17.1
Saco	261	224	203	-9.4
Rest of County	2,425	2,135	1,947	-19.7
Valley County	8,239	7,675	7,270	-11.8
Fort Peck	325	240	232	-28.6
Glasgow	3,572	3,253	3,084	-13.7
Nashua	375	325	307	-18.1
Opheim	145	111	105	-27.6
Rest of County	3,882	3,746	3,542	-7.3

Sources: US Census Bureau 1990 and 2000 Census; Population Division US Census Bureau, Annual Estimates of the Population for Incorporated Places in Montana, by County: April 1, 2000 to July 1, 2004.

Population within the study area is anticipated to continue to decline. The Montana Census and Economic Information Center forecasts Phillips County population to decline to 3,830 in 2020, a 349-person or 8 percent decline from the estimated 2005 population of 4,179. Valley County is forecast to decline to 6,190 in 2020, a 953-person or 13 percent loss over the 2005 level of 7,143 (CEIS 2006).

3.8.3 Temporary Housing Resources

This section addresses temporary housing, the category of housing likely to be affected by ongoing natural-gas development. BNGPA drilling, completion, and field-development activities are relatively short-duration tasks performed primarily by contractors. Currently these activities occur during a five-month period each year, resulting in a temporary, transient workforce and demand for temporary housing such as motel rooms and spaces for mobile homes, recreational vehicles (RVs), and rig camps near the project area. Although year-round employment is likely to increase under several of the alternatives, the forecast population losses in the study area would likely preclude impacts to conventional housing resources.

As shown in Table 3.8-5, there are seven mobile home communities in Malta with a total of 119 pads and one in Glasgow with a total of seven pads.

Malta has six hotels/motels with a total of 124 rooms, Saco has one motel with nine rooms, and Glasgow has five motels with a total of 187 rooms.

Malta has two commercial Recreational Vehicle (RV) park/campgrounds with a total of 63 spaces and Glasgow has a total of five RV Park/campgrounds with a total of 131 spaces.

Table 3.8-5. Temporary Housing Units in Communities Near the BNGPA

	Malta		Saco		Glasgow	
	#	# Units	#	# Units	#	# Units
Mobile Home Parks	7	119 pads	--	--	1	7 pads
Hotels/ Motels	6	124 rooms	1	9 rooms	5	187 rooms
RV Park/ Campground	2	63 spaces	--	--	5	131 spaces

Source: BCLLC/Progress Resources Survey 2006

3.8.4 Local Government Service Demand

As noted above, natural gas drilling and field-development activities are largely performed by contractors who relocate to Phillips and Valley counties during July to November of each year. Contract employees typically live in temporary housing during their five-month stay in the area and generally impose demands on a limited range of local government services. As a result of declining population, many county and community facilities were developed for a larger population and therefore have some excess capacity.

Road maintenance is the only substantial demand that natural-gas development has historically placed on county government (Blunt 2006, Dunbar 2006, Peterson 2006, Pippin 2006, Reinhardt 2006). The volumes of traffic in certain areas of the BNGPA, particularly during drilling and field-development periods, coupled with the necessity to access wells, compressor stations, and other gas facilities in all types of weather, results in elevated demand for maintenance on roads that serve wells and facilities. The costs associated with gas-field road maintenance are offset by revenues from the counties' share of the gas production tax allocated to the counties for transportation purposes, by the counties' share of general-purpose gas production taxes, and by the counties' share of federal mineral royalties.

Given the higher level of development anticipated under several alternatives in this analysis, demand may emerge for law enforcement, emergency response, and fire-suppression services in the BNGPA. Services to historic gas field activities in the Bowdoin area have been minimal (Abramson 2006, Dunbar 2006, Meier, 2006. Moran 2006).

Hospital and emergency medical services in the BNGPA are provided by hospitals in Malta and Glasgow. Phillips County Hospital and Family Health Clinic, located in Malta, is a 14-bed Critical Access Hospital and Federally Certified Rural Health Clinic, staffed by one physician, one physician's assistant, and one nurse practitioner. This community-owned health care organization provides medical services to Malta and the surrounding communities, averaging nearly 9,000 primary-care clinic visits per year (EMTN 2006).

Frances Mahon Deaconess Hospital (FMDH), located in Glasgow, is a Joint Commission accredited, acute-care facility licensed for 54 beds (including swing beds). FMDH has two operating-room suites with recovery, a four-bed ICU, a four-bed telemetry unit, a medical/ surgical wing with OB, and an emergency room. The hospital recently completed a $1.2 million remodeling project. Average inpatient daily census is 10 patients, and the hospital performs an average of 120 surgeries per month (most on an outpatient basis). Each month, the emergency room staff sees about 200 patients; each year FMDH delivers approximately 75 babies. MDH has a dedicated, fixed-wing air ambulance that transports patients from throughout northeastern

Montana to tertiary-care facilities located in Billings, Minneapolis/St. Paul and elsewhere (EMTN 2006).

3.8.5 Fiscal Conditions

Mineral and energy resource development is closely linked to fiscal conditions of local governments and school districts in the region. That linkage is the result of direct and indirect contributions to the local property-tax base, gas-production taxes, and federal mineral royalty payments on production from the public mineral estate. It can also yield state corporate and personal income taxes levied on royalties paid to private mineral estate owners.

Taxable Values for Property Taxes

Gas production in Montana is not subject to ad valorem, or property taxes; rather, it is subject to a production tax. The production equipment, gathering and transmission-system pipelines, ancillary facilities, and some equipment classified as pollution-control equipment are, however, subject to ad valorem property tax. Under Montana's property classification system such equipment and improvements are categorized as Class 4 – Commercial and Industrial, Class 5 – Pollution Control Equipment, or Class 9 – Pipelines and non-electrical generating property of electrical utilities. Statutorily established assessment rates to establish taxable value for these classes of property, as a percent of their adjusted market value are 3.3 percent, 3.0 percent, and 12.0 percent, respectively.

Detailed breakdowns of taxable values associated with the natural gas industry are not available. However, as shown in Table 3.8-6, Class 9 property, which includes pipelines, is the single largest category of taxable value in each county; 39 percent of the $13.7 million total taxable valuation in Phillips County and 50 percent of the $24.7 million total in Valley County. Taxable values of the vast areas of private agricultural land are the second category of taxable values in these counties, followed by residential property located principally in the Malta and Glasgow communities, respectively.

Table 3.8-6. Distribution of Assessed Valuation, by Property Class, FY 2004–05

	Phillips County		Valley County	
	Taxable Value	% Total	Taxable Value	% Total
Class 1 – Net Mining Proceeds	$ 0	0	$ 0	0
Class 2 – Gross Proceeds	0	0	0	0
Class 3 – Ag Land	3,744,074	27	4,605,850	19
Class 4 – Residential	1,995,524	15	3,618,508	15
Class 4 – Commercial and Industrial	561,363	4	1, 243,147	5
Class 5 – Pollution Control Equip.	224,806	2	431,049	2
Class 7 – Non-centrally assessed utilities	0	0	0	0
Class 8 – Business Equipment	826,304	6	1,112,473	4
Class 9 – Pipelines & non-electrical generating equip. of elec. Utilities	5,454,225	40	12,426,990	50
Class 10 – Forest land	1,023	0	0	0
Class 12 – Railroads & airlines	727,705	5	1,075,680	4
Class 13 – Telecommunications & Electrical Generating Equip.	212,304	2	217,962	1
TOTAL	**$ 13,747,328**	**100**	**$ 24,731,659**	**100**

Source: Montana Association of Counties, 2006.

Oil and Natural Gas Production Tax. In 1995 the Montana Legislature replaced all existing state and local extraction taxes on oil and natural gas production with a single production tax based on the type of well and production. The tax has been further refined in the intervening years. For all new natural gas production the tax rate on the working interests is 0.50 percent of the value during the first 12 months of production and 9.0 percent of the value of production thereafter. Producers are allowed to deduct the value of produced natural gas subsequently used in the production of gas. The tax rate on royalty interests is 14.80 percent. In 2005, the state legislature also enacted a privilege and license tax on oil and gas production, a portion of which funds local impact aid. All governmental royalties are exempt from taxation. (Montana Department of Revenue 2006.)

Revenues generated by the production tax are collected by the state, with subsequent disbursement of a share of the revenues distributed to the county and school district in which the production occurs, according to a legislatively established allocation formula. The state's share is 45.98 percent on production in Phillips County and 48.53 percent in Valley County (15-36-331 M.C.A.). The majority of the state's share is deposited in the general fund, with smaller shares earmarked for the Board of Oil and Gas Conservation, the University system, and other accounts. Portions of production taxes distributed to the two counties are in turn distributed among the public school retirement accounts, county-wide transportation purposes, and the school district(s), within which the production occurred. Finally, one-third is retained by the county and the other two-thirds distributed to incorporated cities and towns in the respective counties (15-36-332 M.C.A.). The current allocations of the local distributions from the oil and gas production tax are shown in Table 3.8-7.

Table 3.8-7. Statutory Allocations of the Local Shares of the Oil and Gas Production Tax

	Phillips County	Valley County
Elementary Retirement	0.43%	2.26%
High School Retirement	6.60%	12.61%
Countywide Transportation	1.08%	4.63%
School Districts	41.29%	41.11%
County General Purpose	16.87%	13.13%
Municipalities in the County	33.73%	26.26%

Source: Montana State Legislature, 2005.

In 2005, five of the nine potentially affected districts received distributions of natural gas production taxes. Those districts are Saco Elementary, Saco High School, Whitewater K-12, Hinsdale Elementary, and Hinsdale High School.

Federal Mineral Royalties (FMR). Mineral and energy resource producers generally pay a 12.5 percent royalty to the federal treasury on the value of all surface coal, natural gas, oil, and other minerals produced on federal leases. One-half of the FMR receipts are subsequently disbursed to the state in which the production occurred. The volume of production, recent rising market prices for gas, size of the resource base, and large share of federal mineral ownership combine to make federal mineral royalties an important revenue source.

Under Montana statute, 25 percent of the state's annual FMR receipts are deposited into a mineral impact account (17-3-240 M.C.A.). Monies deposited into that account are then distributed to counties from which the minerals were produced. The distribution is statutorily

appropriated. The current distribution allocations and appropriations for FY 2005 and FY 2006 are summarized in Table 3.8-8 below.

Table 3.8-8. Distributions of Federal Mineral Royalties, FY 2005 and 2006

	Phillips County	Valley County	Montana Statewide
Percent of State Total *	9.1584%	1.0139%	n/a
FY 2005 Distribution	$ 373,171	$ 45,171	$ 14,009,604
FY 2006 Distribution	$ 826,694	$ 91,520	$ 36,106,573
Increase	$ 453,523	$ 46,349	$ 22,096,969

* Percent of the 25 percent distributed to counties.

Source: Montana Association of Counties, 2006.

Under the current appropriations Phillips and Valley counties collectively receive 10.17 percent of the annual distributions to local counties. In response to sharp increases in market price, the combined total rose by 119 percent to $918,214 between FY 2005 and FY 2006. Reflecting the differences in production levels, the Phillips County share of disbursements is substantially larger than the Valley County share. Phillips County allocated FMR receipts to a variety of uses, including its road-maintenance program. FMR receipts support the general fund in Valley County.

County and Municipal Fiscal Conditions

Given the location of the producing resources, natural-gas development in the region most directly affects fiscal conditions for county governments. Not only do the counties receive royalty and tax revenues generated by the production and the associated capital equipment, but they face additional demands for services, principally in the form of demands on local roads. In addition, such development indirectly affects local communities through local services provided to workers and their families, as well as indirect effects on local revenues.

Most traditional government administrative services associated with local government are included in the general fund. Road maintenance is generally covered under a separate budget, as are other services and enterprise operations. Depending on the jurisdiction, such other functions include landfill operations, solid-waste disposal, airport operations, water and wastewater systems, and public safety.

Table 3.8-9 below shows selected budget data for Phillips County and Valley County, and the cities of Malta and Glasgow. Differences in the governmental organization of the counties are suggested in the differences in the general fund expenditures budgets, $1.87 million for Phillips County and $3.19 million for Valley County. However, total annual expenditures are more comparable in magnitude: $7.95 million and $8.49 million, respectively. Employment levels of the two counties are also comparable: 57 employees in Phillips County and 60 in Valley County.

Table 3.8-9. Selected Financial Characteristics for Affected Units of Local Government

	Taxable Valuation 2005-06	Property Tax Mills 2005-06	Budgeted FY 2006 Expenditures		Budgeted Employees **
			General Fund	Total *	
Phillips County	$ 13,829,064	77.52	$ 1,869,150	$ 7,950,088	57
City of Malta	$ 1,613,031	142.00	$ 573,217	$ 3,028,830	18
Valley County	$ 24,806,426	105.22	$ 3,192,263	$ 8,492,913	60
City of Glasgow	$ 2,673,415	236.00	$ 1,352,652	$ 6,108,646	41

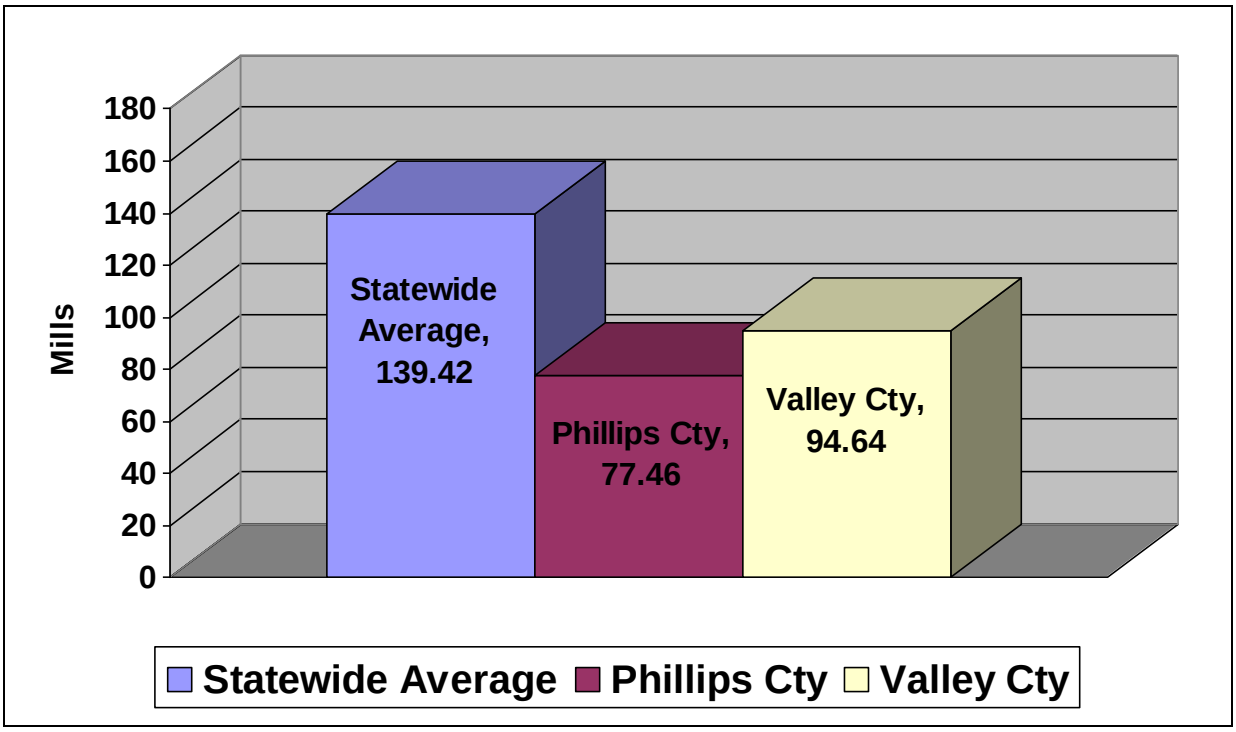
* The totals include all operating, enterprise and capital funds reported by the entity.
** Includes elected officials.
Source: Annual Budgets filed with the Montana State Department of Administration.

The budgets of Malta and Glasgow, $3.02 million and $6.1 million in total expenditures, respectively, reflect differences in the sizes of the community, the services provided by local government and programmed capital outlays, the latter of which vary from year to year. The differences are also apparent in the staffing levels: 18 employees and elected officials in Malta, compared to 41 in Glasgow.

As described above, Phillips and Valley county governments, incorporated communities, and some school districts receive revenues from natural gas production taxes and ad valorem property taxes on certain gas field and pipeline facilities. Natural gas revenues distributed to local governments and school districts affect residents in two ways. In some cases, the additional revenue allows a higher level of government and/or school district service than would be available without these revenues. In other cases, the availability of natural gas revenue reduces the tax burden on residential, commercial and other industrial property taxpayers within the county or school district. These benefits can be offset by higher service demand associated with natural gas activities; however, in Phillips and Valley counties, road maintenance appears to be the only government function that requires a higher level of service as a result of natural gas industry activities (Blunt 2006, Dunbar 2006, Peterson 2006, Pippin 2006, Reinhardt 2006).

Figure 3.8-7 contrasts county levies for Phillips and Valley counties with the average for all Montana counties. In 2004, Phillips County levied a total of 77.46 mills, Valley County levied a total of 94.64 mills and the statewide average for all counties was 139.42 mills. Although not strictly comparable because counties make different choices about the types and levels of services they provide, revenue from natural gas production, facilities, and federal mineral royalties reduces the tax burden for all other Phillips and Valley county taxpayers.

Figure 3.8-7. 2004 County Assessed Mill Levies: Phillips and Valley Counties and Montana Statewide Average



Source: Montana Department of Revenue 2005

3.8.6 Affected Groups

This section is based on scoping comments; interviews with local officials and staff of federal, state, and local government and nongovernmental organizations; and secondary sources as cited.

As indicated in the preceding sections, the study area is largely rural. Slightly more than half of the residents of Phillips and Valley counties live on ranches or farms or in small communities; slightly less than half live in Malta or Glasgow, the two county seats. Social conditions in the area include a relatively high degree of community cohesion and community attachment (BLM 1992, BPDC 2006). Self-reliance, rural/small-town life, uncrowded surroundings and access to outdoor recreation are valued by many study-area residents (BLM and Sonoran Institute, 2001 and 2007).

Population loss is a long-term trend affecting social conditions in the study area (described in section 3.8.2) as young people leave the area to seek higher education and employment opportunities. The consolidation of farms and enrollment of farm lands in the federal Conservation Reserve Program, which reduces the local agricultural economy, have accelerated population loss in the two counties as have the closure of the Zortman and Landusky mines in Phillips County and the closure of the Glasgow Air Force Base in Valley County.

Natural-gas development and production has been ongoing for over 80 years in the Bowdoin area. As a result, current and historic effects of natural-gas development on general social conditions and on specific groups are well known. The direct effects of natural-gas development

are largely economic. The economic aspects of gas development have indirect effects on social conditions by slowing population loss through the creation of direct and indirect employment opportunities, reducing the tax burden on local property owners and residents and by helping fund public facilities and services, all of which contribute to community well-being and quality of life. Several factors associated with natural-gas development in the BNGPA have combined to help avoid adverse social effects sometimes associated with resource development. These include the long-term duration of development which has bred familiarity with natural-gas development and production activities, the relatively low profile and minimal footprint of the gas wells and most facilities, the dispersed nature of development, and the fact that drilling and field development typically involves a limited number of temporary crews and workers dispersed across a large area. Communities in Phillips and Valley counties have not experienced the large and rapid influx of workers and population associated with many recent resource development projects, because much of the direct employment associated with field production and indirect employment associated with both drilling and production involves existing residents.

Natural-gas development has also resulted in land-use effects. In some cases natural gas activities occupy the same land as agricultural and recreational users, which has the potential to affect social conditions by generating conflict, dissatisfaction, and a reduction in the well-being and quality of life of affected individuals and groups.

Two specific groups have been affected by natural-gas development in the BNGPA. These include ranchers, farmers, and livestock grazing permittees who occupy split-estate lands[1] or lease BLM lands that have hosted natural-gas development and recreationists who use lands and recreation resources within the BNGPA. Additionally, two groups have expressed an interest in further gas development in the BNGPA. These include groups and individuals who place a high priority on resource protection, and groups and individuals who place a high priority on resource use. These groups are similar to groups who have been identified for other land and resource management assessments in Montana, including the recent Upper Missouri Breaks National Monument Draft Resource Management Plan and Environmental Impact Statement, which included a four-county area including Phillips County (BLM 2005). Membership in any of these groups is not mutually exclusive. An individual may be a member of more than one affected group. For example, ranchers and farmers may also be recreationists and ranchers, farmers and recreationists may also give a high priority to resource protection or resource use. Some individuals and groups who give a high priority to resource use may do so in part because they believe that environmental values can be protected as resources are used.

The key perspectives and linkages of each of these four groups to historic natural-gas development in the BNGPA are discussed below.

Ranchers, Farmers and Livestock Permittees

Ranching to raise livestock, including its linkage to grazing on public lands, is the major agricultural activity in the study area although some crop farming also occurs. Members of the ranching and farming community typically have strong attachment to the land and many farms and ranches are intergenerational, passed down from the fathers and mothers of one generation to the sons, daughters, and in-laws of the next. The recent difficult economic environment for agriculture has contributed to population loss in the county as some children of

[1] A split-estate situation occurs when the surface rights and subsurface rights (such as the rights to develop minerals) for a parcel of land are owned by different parties and are said to have been severed. For split estate, mineral rights dominate, or take precedence over, other rights associated with the property, including those associated with owning the surface (US BLM 2006).

ranching families choose to pursue other careers and some ranchers and farmers choose to enroll their lands in the federal Conservation Reserve Program, which has had adverse secondary effects on industries that supply equipment and other goods and services to farmers and ranchers.

On split-estate lands, natural-gas development has at times come in conflict with the generally shared values of the ranching and farming community including autonomy, attachment to the land, self-reliance, the exercise of control over access and land use, and a preference for a quiet, rural environment. Historically these conflicts have led to a decrease in well-being and diminished quality of life for some ranchers and farmers.

Some surface owners of split-estate lands and grazing users of BLM lands have experienced dissatisfaction or conflict when natural gas operators have entered and used a portion of the surface estate in order to access the natural gas resources associated with the mineral estate. Sources of dissatisfaction and conflict include surface disturbance with associated acceleration of soil erosion and incursion of weeds, alteration of crop or grazing lands, and disruption of cultivation and grazing activities, traffic and dust associated with well and ancillary facility development and ongoing access, noise and visual intrusions, perceived change in the landscape and aesthetic values, and concern that water quantity and quality and property values could be negatively affected. Some ranchers and farmers who operate on split-estate lands have taken legal and political action to address these issues.

Surface owners in the Bowdoin area are typically paid a one-time surface damage payment. Where the mineral estate is administered by the BLM, surface owners have the right to participate in the BLM's on-site inspections during the Notice of Staking and Application for Permit to Drill process and are entitled to the same level of surface protection provided on federal surface. These and other surface-owner rights on split-estate lands where the BLM administers the mineral estate are specified in the BLM publication *Split Estate: Rights, Responsibilities and Opportunities* (BLM/WO/GI-06/022+3161).

In contrast to split-estate lands where the BLM holds the mineral interest, farmers and ranchers who own mineral rights and have leases with the Operators typically receive revenue for leases and, if a well is located on the lease, they receive royalties based on production value. Because members of this group have entered into these leases as business arrangements, they are more likely to perceive natural-gas development as beneficial, and less likely to experience conflict with the Operators because they have contractual arrangements that control the manner in which development on their land occurs.

Recreationists

Recreation users of lands within the BNGPA include residents of the area, other residents of Montana and residents of other states. Recreational use of lands within the BNGPA, described in the section **3.7.1, Recreation**, includes hunting, fishing, pleasure driving (including off-highway vehicle rides), and wildlife observation. Boating, picnicking, and camping also occur in the project area, but are limited to Nelson Reservoir. According to Section 3.7.1, recreation use of public lands within the BNGPA is believed to be moderate. Recreationists can be affected by natural-gas development and production activities and facilities that change the recreation setting and disrupt wildlife patterns for wildlife viewers and hunters. For residents of the BNGPA and other users, these effects can result in dissatisfaction and a perceived reduction in well-being and quality of life.

The large size of the BNGPA combined with the fact that drilling and field development operations have typically involved only one or two rigs and associated completion and gathering-system construction crews during the drilling/field-development season has historically resulted in a relatively low potential for conflict between recreation users and drilling/field-development activities. Similarly, given the generally unobtrusive profile of wells within the BNGPA and low volume of traffic associated with production operations, the potential for conflict between recreation users and natural gas production operations has similarly been low. According to the recreation assessment in section 3.7.1, the areas around Nelson Reservoir, along the Milk River, and near the Bowdoin National Wildlife Refuge complex have the highest potential for sensitivity to changes in the recreation setting.

A subset of recreation users in the BNGPA are the 106 leaseholders on BOR lands at Nelson Reservoir. Leaseholders own cabins and other improvements on the leases; the surrounding lands contain natural gas wells. Gas wells and recreation cabins have coexisted for sometime in the Nelson Reservoir area; in many cases the gas development predates the construction of cabins. According to Section 3.7.1, no issues or conflicts between cabin owners and natural-gas development have been reported to the Nelson Reservoir Recreation Association.

Individuals and Groups Who Give a High Priority to Resource Protection

During the scoping process, representatives of regional and national organizations have identified environmental and resource-use concerns and issues associated with gas development in the BNGPA. These groups have expressed concern that best management practices, rigorous analyses, and strong resource protection measures be implemented to avoid damage to environmental values and natural resources, both within and outside the BNGPA.

Individuals and Groups Who Give a High Priority to Resource Use

A number of individuals and organizations have expressed support for development of the natural gas resources within the BNGPA. The justification for this support is generally economic and fiscal, expressed in terms of jobs, income and local and state tax revenues. Some individuals who support development in the BNGPA have expressed the belief that development has been accomplished with minimal environmental degradation.

3.8.7 Environmental Justice

Executive Order (EO) 12898, “Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations” was published in the *Federal Register* (59 FR 7629) on February 11, 1994. EO 12898 requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies and activities on minority populations and low-income populations. Low-income populations are defined as those living below the poverty level.

Implementation of EO 12898 for NEPA requires two steps:

- Identifying the presence of minority and low-income populations in areas that may be affected by the action under consideration.

- Determining if the action under consideration would have disproportionately high and adverse human health or environmental effects on identified minority or low-income populations.

Minority Populations within and near the BNGPA

Table 3.8-10 identifies the percentage of minorities in areas relevant to Bowdoin Natural Gas Project. The percentage of minority residents of Phillips and Valley counties is not meaningfully higher than 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.

Table 3.8-10. Percentage of Minorities in the U.S., Montana, Areas Within and Near the BNGPA, Nearby Communities, Montana and U.S.

	Percentage of Total Population					
Geographic Area	White Alone	American Indian and Alaska Native Alone	Hispanic or Latino	Hispanic or Latino and White Alone	Racial and Ethnic Minorities	Percentage of Minority Population Above/Below the State Average
United States	75.1	0.9	12.5	6.0	30.9	20.4
Montana	90.6	6.2	2.0	1.0	10.5	0.0
Phillips County	89.4	7.6	1.2	0.7	11.2	0.8
Valley County	88.1	9.4	0.8	0.3	12.2	1.7
Census Block Groups around the BNGPA						
Phillips County Census Block Group 601-1	90.8	6.1	0.8	0.3	9.6	-0.9
Valley County Census Block Group 1001-1	97.7	0.9	1.0	0.3	2.6	-7.8
Nearby Communities						
Malta	92.8	4.7	1.0	0.8	8.0	-2.5
Saco	96.4	1.8	0.0	0.0	3.6	-6.9

Source: 2000 US Census, US Census Bureau, Summary File 1.

Note 1: Racial minorities includes all persons identifying themselves in the census as a non-white race, including "Black or African American," "American Indian and Alaska Native," "Asian." "Native Hawaiian and Other Pacific Islander," "Some other race alone," and "Two or more races." Ethnic minorities include persons who identify themselves as Hispanic or Latino.

Note 2: As Hispanic or Latino persons can identify themselves as part of any race, the calculation used to determine racial and ethnic minorities would be (a) taking all persons who did not identify themselves as white alone and adding Hispanic or Latino and White alone individuals. For the United States, this would be (1-75.1%+6%) or 30.9%.

As shown in Table 3.8-11, three Native American Tribes have trust lands within Phillips and Valley counties.

- A number of parcels of Turtle Mountain Tribal Trust lands are located within and near the project area, but these lands are not occupied by Tribal members. Both surface and mineral estates associated with these lands are administered from the Fort Belknap Reservation.
- A portion of the Fort Belknap Indian Reservation is within Phillips County about 40 miles to the south and west of the project area. According to the 2000 Census, the American Indian population of the reservation was 2,790 persons, 94 percent of the total reservation population.

- A portion of the Fort Peck Indian Reservation is located in Valley County, about 40 miles east of the project area. According to the 2000 Census, the American Indian population of the reservation was 6,391 persons, 62 percent of total reservation population.

Table 3.8-11. American Indian Populations Associated With Reservations and Trust Lands Within and Near the BNGPA

Description of American Indian Lands	Proximity to Project Area	Total Population	American Indian and Alaska Native Population	Percent of Total Population American Indian and Alaska Native
Turtle Mountain Off-Reservation Trust Land	In and near BNGPA	0	0	0.0%
Fort Belknap Reservation and Off-Reservation Trust Land, MT	Approximately 40 Miles southwest of BNGPA	2,959	2,790	94.3%
Fort Peck Reservation and Off-Reservation Trust Land, MT	Approximately 40 miles East of BNGPA	10,321	6,391	61.9%

Source: 2000 US Census, US Census Bureau, Summary File 1.

Low-Income Populations within and near the BNGPA

As shown in Table 3.8-12, the percentage of low-income persons in the State of Montana was 2.2 percent higher than the nation at the time of the 2000 census. The percentage of low-income persons in Valley County was lower than the state as a whole, but the Phillips County poverty rate was 3.7 percent higher than the statewide average.

Valley County census block group 1001-1, which contains a portion of the BNGPA, was 0.4 percent higher than the state. Phillips County census block group 601-1, which contains most of Phillips County north of US Highway 2 and the bulk of the BNGPA, had a 10.1 percent higher poverty rate than the statewide average. Although higher than the statewide average, the large size of census block group 601-1, the relatively small number of residents below the poverty level (116 persons), and the dispersed nature of the population within the census block do not indicate an environmental justice population based on poverty standards.

The Town of Saco, the only incorporated community within the BNGPA had a smaller percentage of people in poverty than the statewide average.

Table 3.8-12. Percentage of Low-Income Population Within and Near the BNGPA, Nearby Communities, Montana and U.S.

	Percentage of Total Population			Percentage of Low Income (Below Poverty) Above/Below the State Average Poverty Level
	Below Poverty Level	Below 150% of Poverty Level	Below 200% of Poverty Level	
Geographic Area				
United States	12.4	20.9	29.6	-2.2
Montana	14.6	25.7	37.1	0.0
Phillips County	18.3	29.8	41.4	3.7
Valley County	13.5	26.0	36.4	-1.1
Census Block Groups around the BNGPA				
Phillips County Census Block Group 601-1	24.7	38.2	50.5	10.1
Valley County Census Block Group 1001-1	15.0	29.8	40.5	0.4
Nearby Communities				
Malta	13.1	24.7	36.4	-1.5
Saco	14.0	31.0	39.7	-0.6

Source: 2000 US Census, US Census Bureau, Summary File 3.

Public Participation

Public participation by potentially affected minority and low-income groups is also important for environmental justice compliance. The EPA guidance for incorporating environmental justice concerns in NEPA assessments requires that potentially affected Indian Tribes be offered cooperating agency status under CFR 1508.5 (USEPA 1998). In addition to the standard scoping process for the BNGPA, the BLM consulted directly with affected tribes to determine their interest in the BNGPA and the proposed project. This consultation process is described in Section 5 of this EA.

3.9 SOILS

Introduction

Soils in the BNGPA are derived from glacial till, sedimentary bedrock, and alluvium from mixed rock sources. The BNGPA is within the Great Plains Physiographic Province and the Glaciated Missouri Plateau. Annual precipitation averages 12.7 inches and the frost-free period is generally from 90 to 131 days.

Soil information presented in this section is derived from the Soil Survey of Phillips County Area, Montana (NRCS, 2004), Soil Survey of Valley County, Montana (SCS, 1984), the National Soils Information System (NASIS) database (NASIS, 2006), and the Final Judith Valley Phillips Resource Management Plan, Environmental Impact Statement (BLM, October 1992). Because of the availability of complete, current soil survey information for the project area, a sound description of the affected environment and analysis of environmental consequences is possible.

A total of 171 consociations, complexes, associations, taxadjuncts, and variant map units occur within the BNGPA. Mollisols, with 310,685 acres at roughly 38 percent of the project area, make up the largest percentage of soil orders in the BNGPA. Entisols, with 188,263 acres and 23 percent of the project area, are also a predominant soil order. Alfisols, with 89,893 acres at 11 percent, and Vertisols, with 50,247 acres at 6 percent, are also major soil orders present in the project area. Minor areas of roughly 2 percent each of Aridisols, Inceptisols, and rock outcrop/ water/badland areas, are also present.

According to the Phillips County Soil Survey (NRCS, 2004) the majority of the project area is used as rangeland. A small portion of the project area is used for dryland and irrigated farming. The principal dryland crop is wheat and the main irrigated crops are small grains and alfalfa, used for hay. Approximately 32 percent, or 259,349 acres, of the soils in the BNGPA are considered farmland of statewide importance.

3.9.1 General Description of Major Soil Types

Three major soil types are present within the BNGPA: glacial till upland and glacial outwash soils, sedimentary upland soils, and alluvial soils. Glacial till upland and glacial outwash soils in the BNGPA formed from glacial till deposited near the end of the Tertiary Period, between 130,000 and 15,000 years ago. The glacial till ranges from a few feet to 50 feet thick and is generally underlain by clayey and loamy shale. Soils formed in glacial till are loamy or clayey, depending upon the texture of the glacial till. Soils that formed in outwash material generally have a high percentage of sand and gravel.

Sedimentary upland soils in the BNGPA are derived from shale and sandstone. Soils formed from shale parent materials are generally clayey while soils formed in sandstone parent material are more sandy. Some sedimentary parent materials, such as marine shales, can be high in salts and sodium, leading to the formation of saline and/or sodic soils.

Alluvial soils in the BNGPA developed in alluvium from mixed rock sources, predominantly alluvial materials from clay shale, sandstone, and glacial till. These soils formed on flood plains, terraces, and alluvial fans. Alluvial soils range from sandy to clayey, depending on the source material. Local areas have rock fragments throughout the soil or in the underlying parent material.

3.9.2 Soil Limitations

To assess the potential limitations of the BNGPA soils, four areas of concern were addressed. Water erosion hazard, wind erosion hazard, vehicle trafficability (mobility), and reclamation potential were assessed using soils information from the NASIS database. Results are summarized in Table 3.9-1 with a discussion provided for each category below.

Water Erosion Hazard. To assess the potential hazard for soil erosion caused by water, the soil-erosion factor Kw and soil slope values were obtained from the NASIS database for each soil mapping unit and ranked for hazard to erosion. Kw indicates the susceptibility of a soil to sheet and rill erosion (Institute of Water Research, 2002). It is one of the six factors used in the Revised Universal Soil Loss Equation to predict the average annual rate of soil loss by water erosion. K is based on percentage of silt, sand, and organic matter, soil structure, and hydraulic conductivity (USDA-NRCS, 2007).

Water erosion hazard rankings were determined for each soil mapping unit within the BNGPA by multiplying the surface soil horizon Kw factor by the slope and plotting the product as shown on Figure 3.9-1. Depending on where the product was graphed on Figure 3.9-1, the soil was ranked as having a slight, moderate, or severe water erosion hazard. Water erosion hazard for the soils of the BNGPA is shown in Table 3.9-1 and Figure 3.9-2. Seventy-six percent, or 621,181 acres, of the BNGPA is predominantly rated as having a slight water erosion hazard (Table 3.9-1). Only 16 percent, or 128,233 acres, is rated as having a severe water erosion hazard.

Wind Erosion Hazard. To assess the potential hazard for soil erosion caused by wind, the wind erodibility index (WEI) was obtained from the NASIS database for each soil mapping unit. The WEI is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. The WEI correlates to the wind erosion group. Soils are grouped for susceptibility to wind erosion based on percent sand, silt, and clay; calcium carbonate content; presence of surficial coarse fragments; and surface wetness conditions (USDA-NRCS, 2007).

Soils with a WEI of 0, 38, 48, or 56 are considered to have a slight hazard for wind erosion; soils with a WEI of 86 have a moderate hazard for wind erosion; and soils with a WEI of 134, 160, 180, 220, 250, or 310 are classified as having a severe hazard for wind erosion. Wind erosion hazard for soils of the BNGPA is shown in Figure 3.9-3. Sixty percent of the total project area, or 491,766 acres, of the BNGPA predominantly has a slight hazard for wind erosion (Table 3.9-1). The remaining 38 percent, or 310,278 acres, of the BNGPA is mostly considered moderately erodible.

Vehicle Trafficability. To assess the capacity of the soil to support vehicle traffic during drilling and completion activities, the Military Operation Interpretation—Vehicle Trafficability, Type 7 (50 passes, wet season), was obtained from the NASIS database; to assess the capacity of the soil to support vehicle traffic during production activities, the Military Operation Interpretation—Vehicle Trafficability, Type 6 (50 passes, wet season), was obtained (NASIS, 2007). Trafficability interpretations are based on soil strength, slipperiness, stickiness, large surface stones, and slope. Slipperiness is the condition where the soil has a potential to become slick when used for vehicular traffic; during the wet season this condition is common and persistent. Stickiness is the condition where the soil has a potential to become sticky when used for vehicular traffic. During the dry season, soil stickiness is most common and persistent where the soil is ponded, flooded, or has a high water table; the soil may become sticky after precipitation events, but the condition is not persistent.

Type 7 refers to military category type-7 vehicles; type-7 vehicles are generally rear-wheel-drive and are usually not expected to operate off-road, especially in wet soils. Type-6 vehicles are all-wheel-drive and rear-wheel-drive trucks and trailed vehicles intended primarily for highway use. Trafficability performances were estimated for 50 vehicle passes in the same ruts during wet season conditions.

In the vehicle trafficability rating classes, an ‘excellent’ rating indicates that the soil has characteristics that do not limit trafficability and have very low maintenance. A ‘good’ rating indicates that the soil may have characteristics that limit trafficability but are favorable for use. Good operational performance and low maintenance can be expected. The limitations can be overcome or minimized by special planning, design, or management. A ‘fair’ rating indicates that the soil has characteristics that limit trafficability and are moderately favorable for use. The limitations can be overcome or minimized by special planning, design, or management. Fair

performance, moderate maintenance, and soil degradation can be expected. A 'poor' rating indicates that the soil has characteristics that severely limit trafficability and one or more features that are unfavorable for use. Generally, the limitations cannot be overcome without major soil reclamation, special design, or special management. Poor performance, high maintenance, and soil degradation can be expected.

The BNGPA is predominantly rated as having fair vehicle trafficability with respect to wet roads used during drilling and completion activities, with 69 percent of the project area, or 558,043 acres, having this rating (Figure 3.9-4; Table 3.9-1). The BNGPA is predominantly rated as having good vehicle trafficability with respect to wet roads used during production activities, with 57 percent of the project area, or 464,636 acres, having this rating (Figure 3.9-5; Table 3.9-1). The extent of the soils rated as fair or poor for road construction may be overstated, as the more conservative rating class was chosen for complexes and associations with multiple ratings.

Reclamation Potential. Reclamation is the construction of topographic, soil, and plant conditions following disturbance to allow the area to fully function as part of the ecosystem (Munshower, 1994). BLM's long-term objective of final reclamation is to set the course for eventual ecosystem restoration, including the restoration of the natural vegetation community, hydrology, and wildlife habitats. In most cases, this means returning the land to a condition approximating or equal to that which existed prior to the disturbance. The Operator is generally not responsible for achieving full ecological restoration of the site. Instead the Operator must achieve the short-term stability, visual, hydrological, and productivity objectives of the surface management agency and take the steps necessary to ensure that long-term objectives will be reached through natural processes (USDOI and USDA, 2006).

To determine reclamation potential of the BNGPA area soils, a ranking of several soil parameters, obtained from the NASIS database, was conducted and a reclamation potential class was calculated. The soil parameters included: sand, silt and clay percentage, coarse fragment content, pH, salinity, sodium adsorption ratio (SAR), calcium carbonate content, depth, and soil wetness condition. Appropriate ranking criteria for these parameters were obtained from MDEQ (1998), Schafer (1979), Dollhopf (2006), and are provided in Table 3.9-2.

The BNGPA is considered to primarily have good reclamation potential; approximately 74 percent of the project area, or 603,446 acres, has this ranking (Figure 3.9-6, Table 3.9-1). Even though a soil is considered to have a good reclamation potential, it still may have a limiting feature that may require mitigation. For example, a soil with pH levels outside of the desired range may be limited due to the unavailability of certain plant nutrients; therefore the soil may require amendments to adjust pH.

The limiting features to reclamation are provided in Table 3.9-1. The number of acres of soils with limiting features may be conservatively overstated, as any time a complex or association had multiple limiting features, all were added into the total acreage. Soil pH, SAR, texture, coarse fragments, and salinity are the main limitations to reclamation in the BNGPA.

Table 3.9-1. Potential Soil Limitations Within the BNGPA

Potential Limitation	Rating Class/Limiting Features	Acres	Percent of Total Area
Water Erosion[1]	Slight	621,181	76
	Moderate	53,058	6.5
	Severe	128,233	16
	Not Rated / Water	11,576	1.4
Wind Erosion[2]	Slight	491,766	60
	Moderate	310,278	38
	Severe	1,587	0.2
	Not Rated / Water	10,417	1.3
Vehicle Trafficability - Wet Season Conditions[3]			
Roads Used for Drilling and Completion Operations	Excellent	0	0.0
	Good	729	0.1
	Fair	558,043	69
	Poor	228,931	28
	Not Rated / Water	25,972	3.2
Roads Used During Production Operations	Excellent	729	0.1
	Good	464,636	57
	Fair	130,697	16
	Poor	191,641	24
	Not Rated / Water	25,972	3.2
Reclamation Potential[4]	Good	603,446	74
	Fair	77,346	9.5
	Poor	123,318	15
	Not Rated / Water	9,662	1.2
Reclamation Rationale	pH out of range	803,348	99
	High SAR	352,514	43
	Texture out of range	295,867	36
	Coarse fragments too high	294,556	36
	High salinity	175,721	22
	Shallow soils	101,520	12
	Calcium carbonate too high	33,745	4.1
	Saturated soils	10,352	1.3

[1] To assess the potential for soil erosion caused by water, the soil erosion factor Kw and soil slope values were obtained from the NASIS database.

[2] To assess the potential for soil erosion caused by wind, the wind erodibility index was obtained from the NASIS database.

[3] To assess the capacity of the soil to support vehicle traffic during drilling and completion activities, the Military Operation Interpretation – Vehicle Trafficability, Type 7 (50 passes, wet season), was obtained from the NASIS database; the capacity of the soil to support vehicle traffic during production activities, the Military Operation Interpretation – Vehicle Trafficability, Type 6 (50 passes, wet season), was obtained.

[4] To determine reclamation potential of the BNGPA area soils, a ranking of several soil parameters, obtained from the NASIS database, was conducted. The limiting features should not sum to the total project acreage, as a single soil could be limited by several of the features listed.

Figure 3.9-1. Water Erosion Hazard as Determined by Soil Erosion Factor (Kw) and Slope

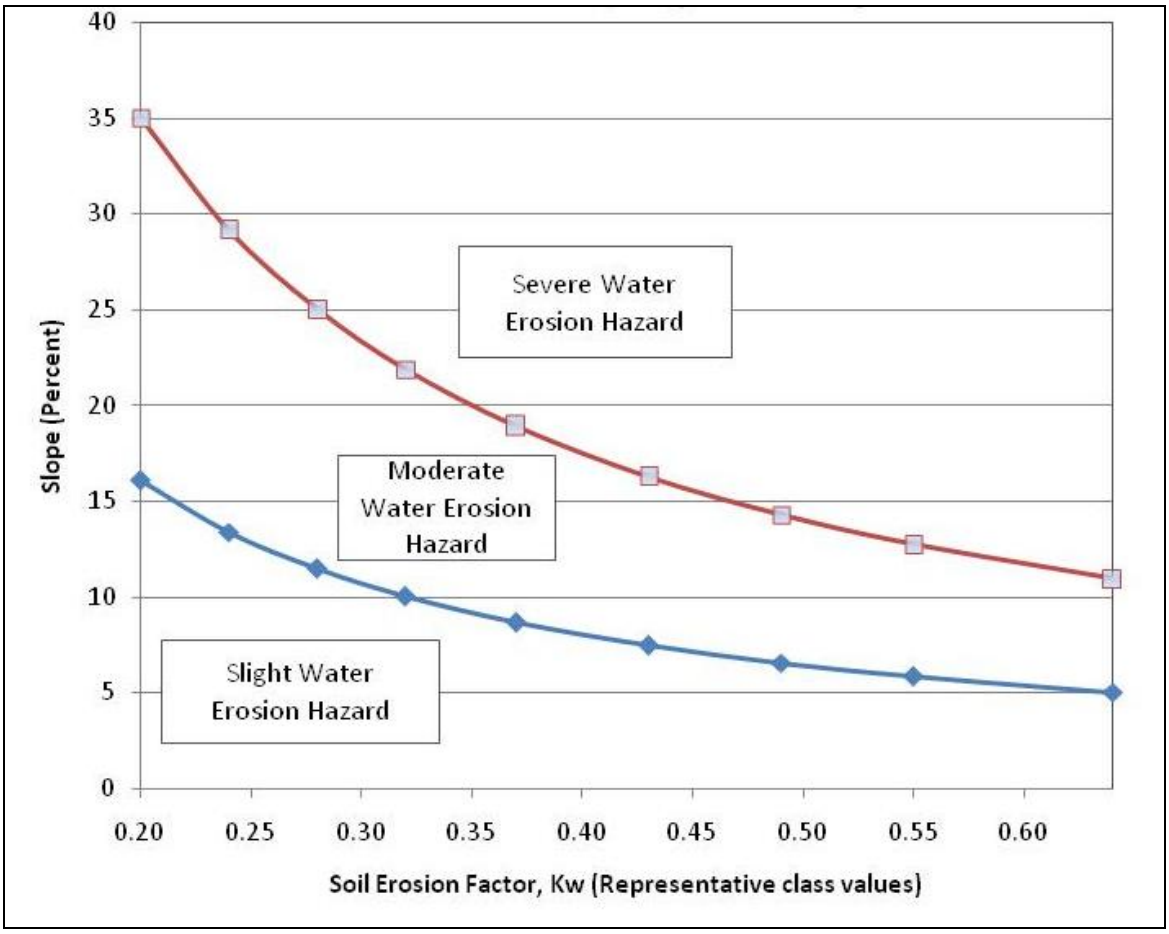


Figure 3.9-2. Water Erosion Hazard of Soils in the BNGPA

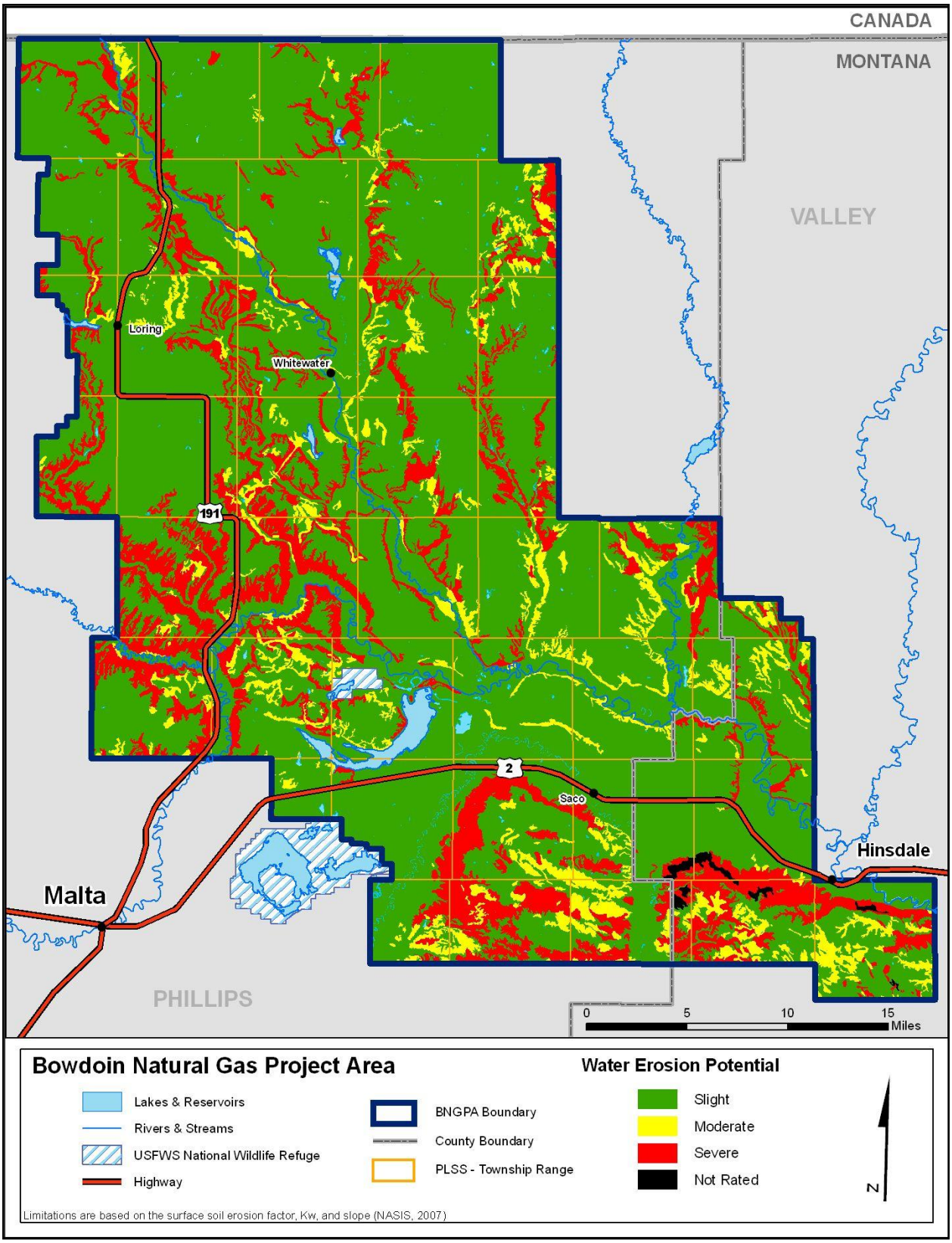


Figure 3.9-3. Wind Erosion Hazard of Soils in the BNGPA

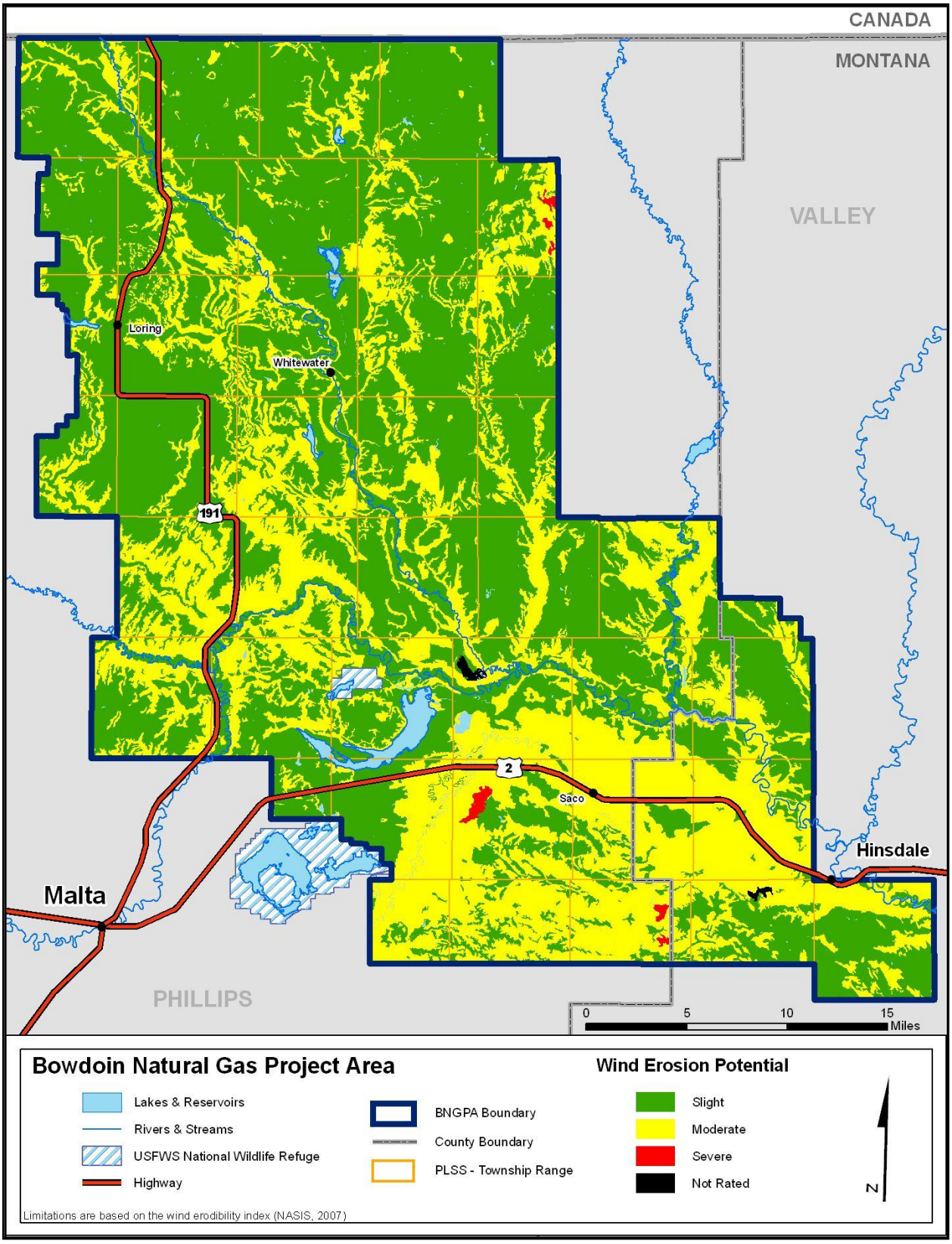


Figure 3.9-4. Vehicle Trafficability for Roads Used During Drilling and Completion Activities in the BNGPA

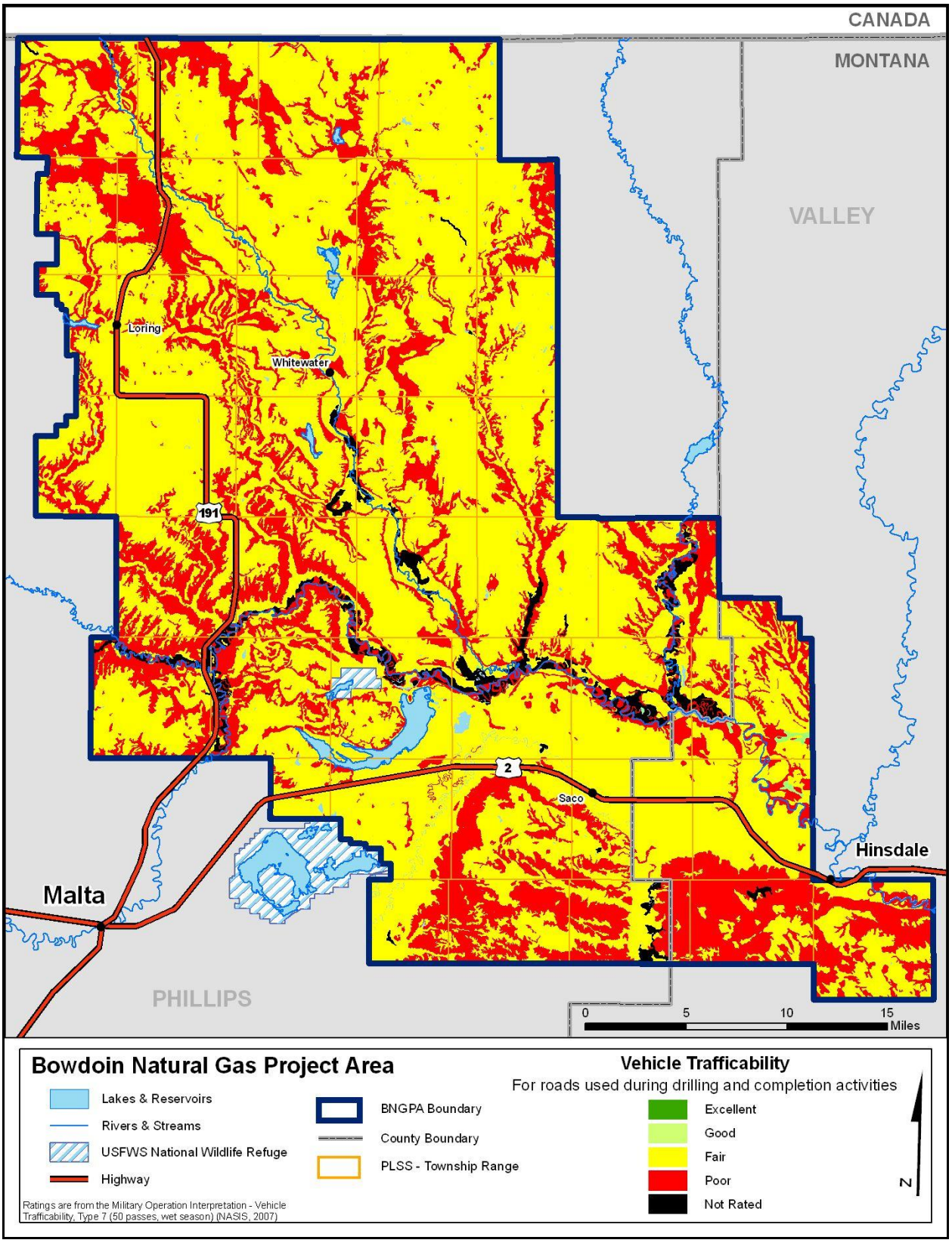


Figure 3.9-5. Vehicle Trafficability for Roads Used During Production Activities in the BNGPA

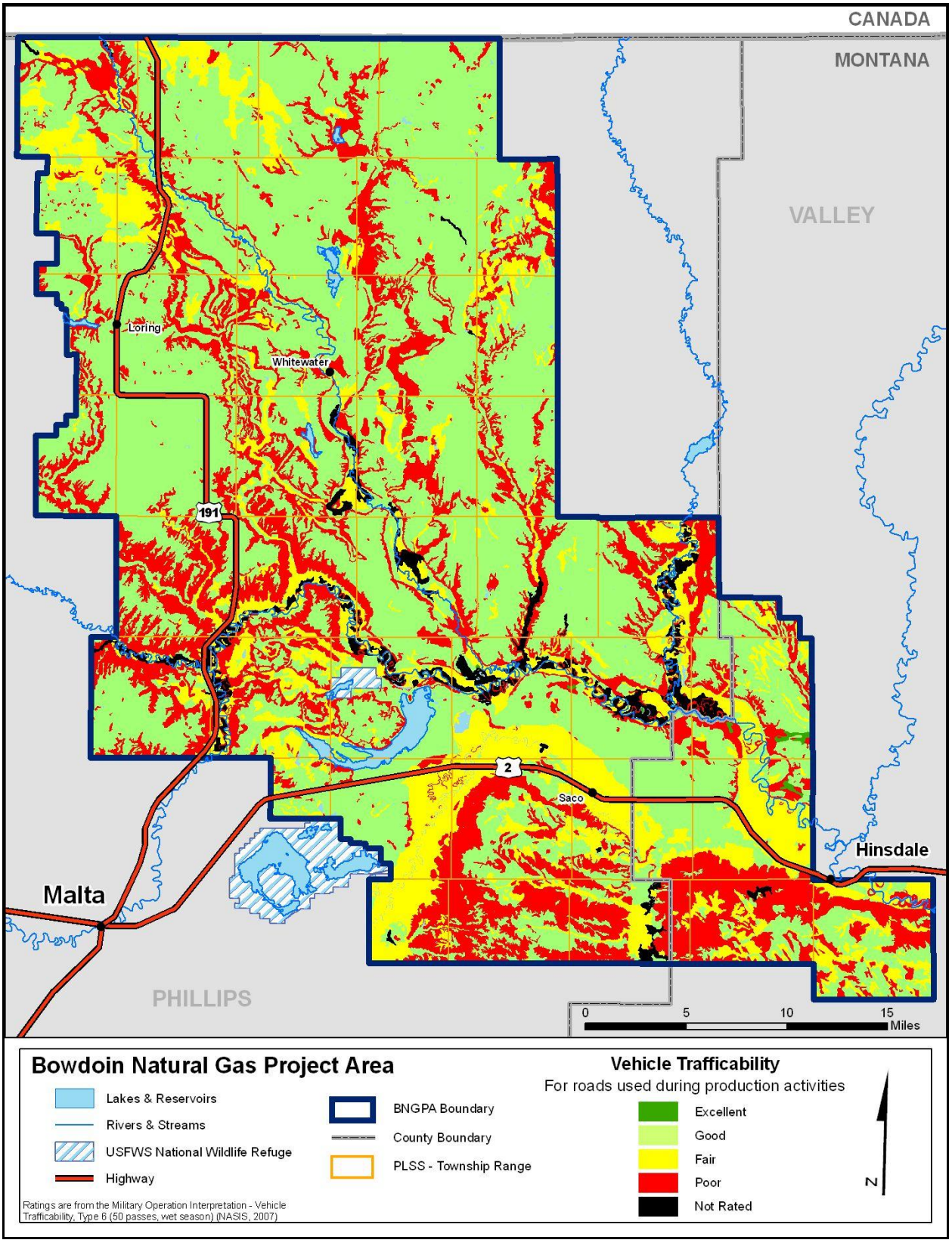
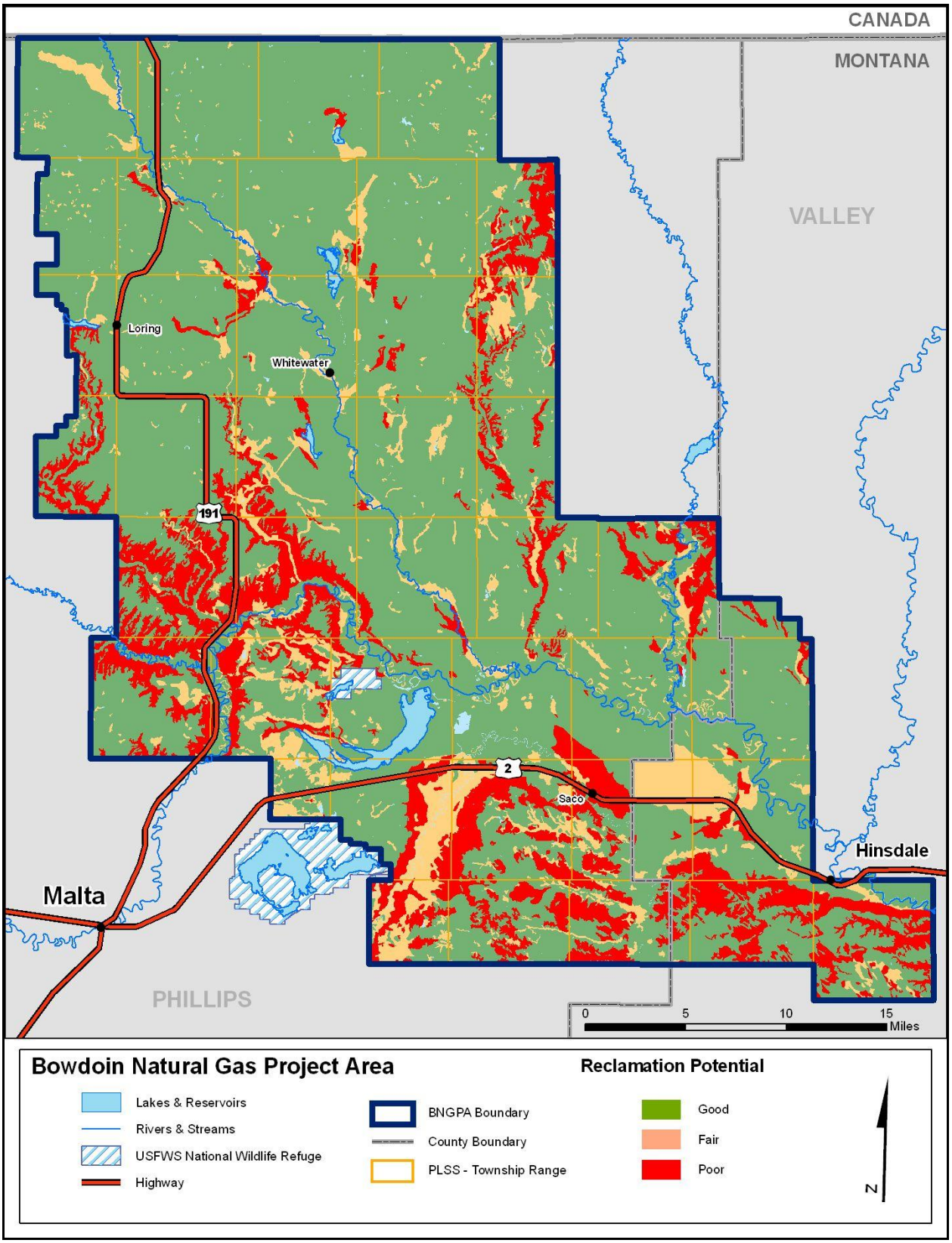


Table 3.9-2. Factors and Criteria Used to Determine Reclamation Potential at the BNGPA

Factors	Units	Good	Fair	Poor
Saturated soils	-	No	-	Yes
Depth	inches	> 24	-	< 24
CaCO3	%	< 15	> 15	-
SAR	-	0 to 4.5	4.5 to 13	> 13
EC	dS/m	0 to 4	4 to 8	> 8
pH	s.u.	5.6 to 7.8	< 5.6 or > 7.8	< 4.5 or > 8.4
Coarse fragments	%	< 15	15 to 35	> 35
Clay	%	≤ 40	> 40	-
Silt	%	≤ 80	> 80	-
Sand	%	≤ 80	> 80	-

Note 1. Criteria are from MDEQ (1998), Schafer (1979), and Dollhopf (2006).

Figure 3.9-6. Reclamation Potential of Soils in the BNGPA



3.10 TRANSPORTATION AND ACCESS

This section describes the surface transportation system that provides access to and within the BNGPA. Surface transportation is the only transportation mode considered in this assessment; it is not anticipated that rail or air transport would be affected by the Proposed Action or alternatives. The existing surface transportation network includes federal and state highways, county, BLM, private and Operator-maintained roads and two-tracks. The existing transportation network is displayed in Figure 3.10-1.

Figure 2.2-1 in Section 2 of this EA is a map of the natural gas infrastructure within the BNGPA. Figure 3.10-2 displays the federal, state, county, and natural gas highway and road infrastructure by surface type.

Table 3.10-1 displays road and highway mileage within the BNGPA by surface ownership. Roads on private land comprise the largest category of roads within the BNGPA—almost 48 percent of total surface. Roads on BLM land make up the second-largest category with almost 26 percent of the total, and county roads are the third-largest category with about 14 percent of the total.

Table 3.10-1. Highway and Road Miles Within the BNGPA by Surface Ownership

Owner	Miles	Percent
U.S. Highway	74	2.21%
Montana State Highway	31	0.92%
County Roads	458	13.66%
Turtle Mountain Allotted Lands	35	1.06%
U.S. Bureau of Land Management	862	25.71%
U.S. Bureau of Reclamation	89	2.66%
U.S. Fish and Wildlife Service	23	0.69%
Montana DNR Water Projects	0.32	0.01%
Montana Fish, Wildlife and Parks	0.39	0.01%
Montana State Trust Lands	181	5.40%
Private Land	1,598	47.67%
TOTAL	3,352	100.00%

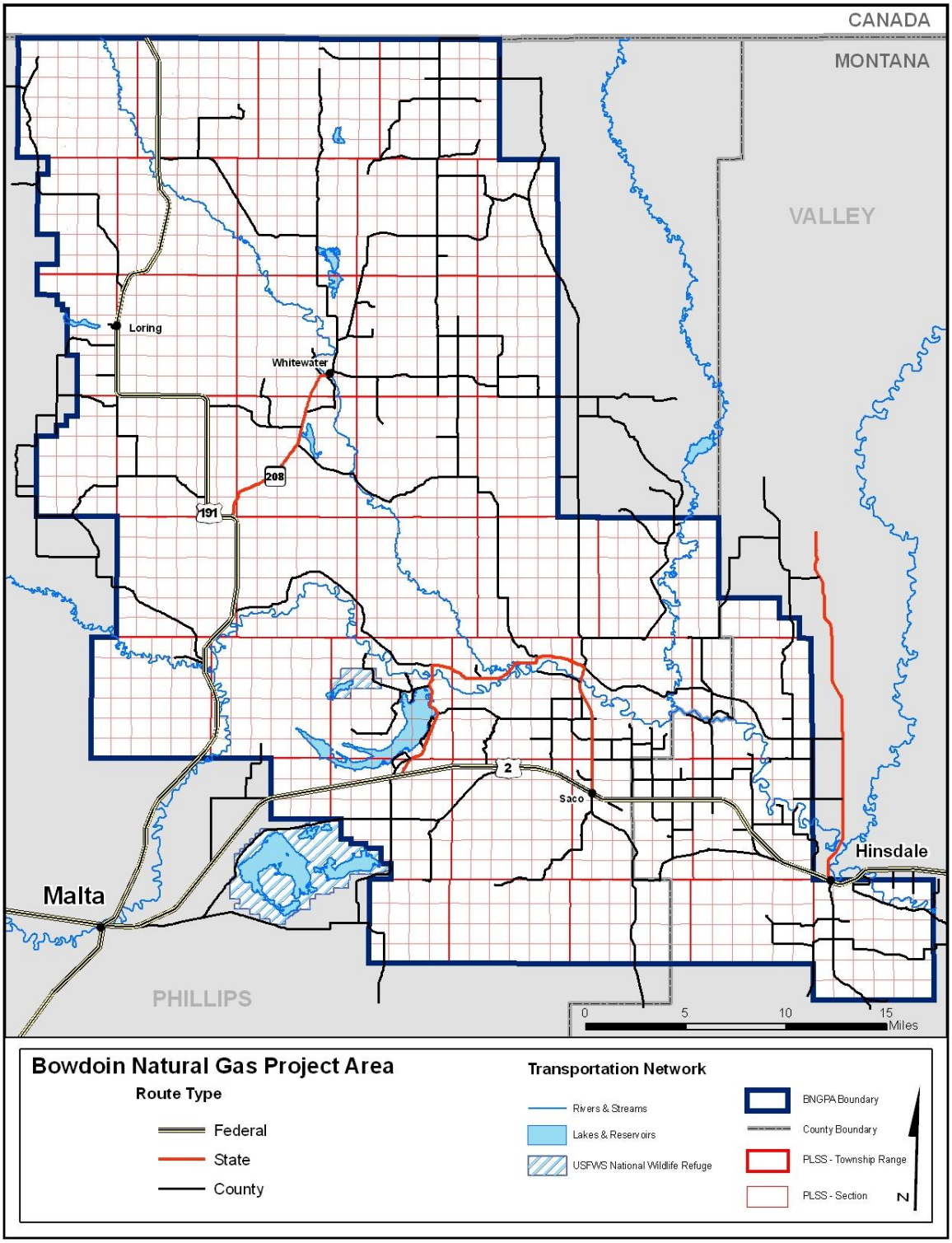
Source: 2005 aerial photograph

3.10.1 Federal and State Highways

The BNGPA is served by two 2-lane principal arterial highways; US 2, which travels west from the North Dakota border to Idaho and is the northern-most highway in the state, and US 191, which travels south from the Canadian border and provides access to Interstate 90 at Billings. US 2 and US 191 intersect at Malta.

Three Montana secondary highways also provide access to the BNGPA: MT 208 (Whitewater Road); MT 243, which provides access to Nelson Reservoir from US 2 and continues on to enter Saco from the north; and MT 537, which travels north from Hinsdale and provides access to the east side of the BNGPA.

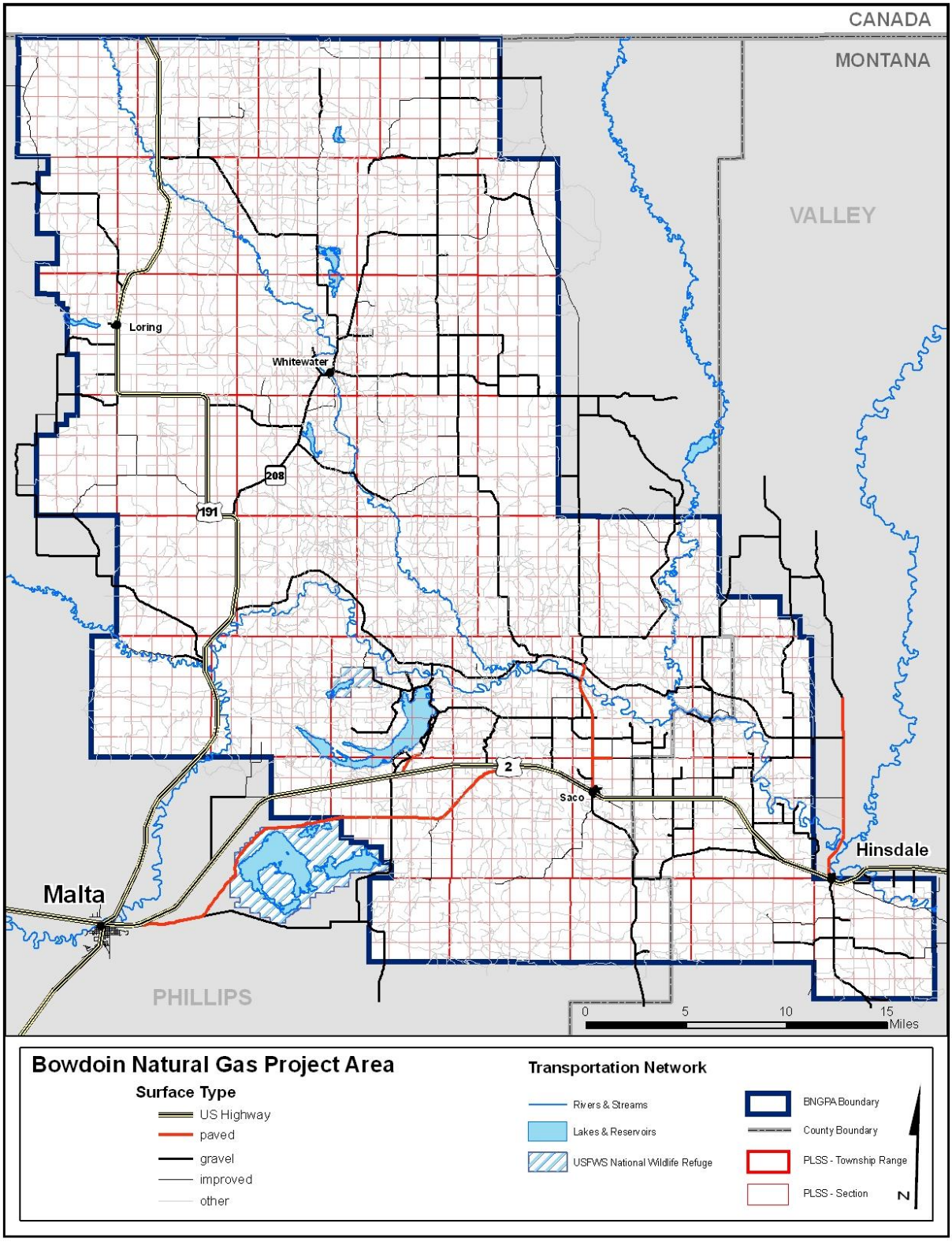
Figure 3.10-1. Highways and Roads Providing Access to and Within the BNGPA, by Ownership



Note: No warranty is made by the Bureau of Land Management for data uses purpose not intended by the BLM. Phillips County road coverages are preliminary and subject to change.

Sources: Montana Department of Transportation, Phillips County, Valley County, US BLM Montana Field Office, Bowdoin Area Operators

Figure 3.10-2. BNGPA Highway and Road Infrastructure by Surface Type



Source: 2005 aerial photograph

Table 3.10-2 displays Montana Department of Transportation (MDT) traffic counts for selected points on these highways within and near the BNGPA. Note that these traffic counts include the BNGPA-related traffic that occurred during each year.

Table 3.10-2. MDT Traffic Counts for Highways Within the BNGPA

Highway/Location	1999	2000	2001	2002	2003	2004	% Chg
US 2							
MP 470.5: 1.5 miles W of US 192, Malta	1,250	1,360	1,350	1,370	1,490	1,660	33%
MP 471.6: NW of Milk River Bridge	3,540	3,830	3,480	3,750	3,850	4,400	24%
MP 472: SE of US191 in Malta	2,370	2,520	2,290	2,460	2,360	2,810	19%
MP 488.5: I mile SW of MT 243	1,130	1,230	1,160	1,060	1,170	1,260	12%
MP 490.5: 1 mile SE of MT 243	1,100	1,170	1,170	1,010	1,130	1,340	22%
MP 511.5: 2 miles NW of Hinsdale	1,010	1,140	1,140	1,090	1,290	1,330	32%
MP 515: 2 miles E of Hinsdale	1,040	1,150	1,260	1,200	1,400	1,270	18%
US 191							
MP 154: 1.3 miles SW of MT 363 near Malta	530	490	560	680	620	580	9%
At BN RR tracks in Malta	4,270	4,360	4,040	4,490	4,500	4,980	17%
North of US 2	610	690	600	610	710	720	18%
6 miles NE of US 2	350	290	310	310	300	310	(11%)
0.7 miles W of MT 208 (Whitewater Rd)	150	130	170	150	150	140	(7%)
3 Miles S of Loring	160	170	170	170	160	130	(19%)
0.5 miles N of Loring	100	110	110	130	110	100	(0%)
At Canadian Border	80	110	110	100	80	70	(13%)
MT 208 (Whitewater Rd)							
0.5 miles N of MT 242	160	160	100	110	110	100	(38%)
MP 9: SW of Whitewater	160	160	150	150	150	110	(31%)
MT 243							
MP 1.5: 1.5 miles NE of US 2	280	260	220	300	260	260	(7%)
Between Elm and Vagg in Saco	1,190	520	520	540	540	530	(55%)*
MT 537							
MP .5: 0.5 miles NW of Hinsdale	130	210	230	230	190	170	31%
MP 10: 10 miles N of US 2/ Hinsdale	80	90	150	120	130	100	25%

* 1999 appears to be an anomaly; between 2000 and 2004 traffic at this location was relatively constant at under half the 1999 level.

Source: MDT traffic counts.

Traffic on US 2 has increased in recent years, with increases ranging from 12 to 33 percent between 1999 and 2004. Traffic on US 191 north of Malta decreased between 1999 and 2004 although there were increases in the intervening years on certain segments. Traffic on MT 208, which provides access to Whitewater from US 191 decreased during the period as did traffic on MT 243, which provides access to Nelson Reservoir and to Saco from the north. Traffic on MT 537 north of Hinsdale increased 25 to 31 percent over the five-year period.

Bid opening for a major reconstruction of MT 208 between US 2 and Whitewater was scheduled for March 2008 (Skinner 2006); potential construction dates and impacts are unknown at this time.

MDT assigns levels of service to highways in the state system. Levels of service (LOS A through LOS F) are assigned based on qualitative measures (speed, travel time, freedom to maneuver, traffic interruptions, comfort, and convenience) that characterize the operational conditions within traffic streams and the perceptions of those conditions by motorists. LOS A represents the best, or free-flowing, travel conditions and LOS F represents the worst, or total stoppage of traffic flows. The LOS ratings for the highway segments accessing the BNGPA are shown in Table 3.10-3. As shown by the table, all highways within the system currently have an LOS of A and anticipate maintaining that level for 20 years, except for US 2, which has an LOS of B.

Table 3.10-3. Level of Service Information for Highways Providing Access to the BNGPA

	Current	5 Year	10 Year	15 Year	20 Year
US 2	B	B	B	B	B
US 191	A	A	A	A	A
MT S -208	A	A	A	A	A
MT S-243	A	A	A	A	A
MT S-537	A	A	A	A	A

Source: Wilson 2006

3.10.2 County Roads

A variety of Phillips and Valley county roads provide access to and within the BNGPA. As shown in Table 3.10-4, about 360 miles of Phillips County roads and 97 miles of Valley County roads lie within the BNGPA. All but 12 miles of the county roads are constructed of gravel or native material. These roads were initially designed for use by farmers and ranchers, but have increasingly been used for gas field development and operations. County roads that access the more intensively developed areas of the BNGPA receive substantial use, which accelerates maintenance demands. Heavy truck traffic and the need to access wells and ancillary facilities when roads are muddy results in demand for higher and more frequent levels of road maintenance than would otherwise be required (Blunt 2006, Dunbar 2006). The costs associated with gas field road maintenance demand are offset by revenues from the counties' share of the gas production tax allocated to the counties for transportation purposes, by the counties' general purpose share of production tax revenues and by the counties' share of federal mineral royalties.

Table 3.10-4. Phillips and Valley County Roads Providing Access to the BNGPA

Total Miles/County		Total Miles/Surface			
Phillips	Valley	Paved	Gravel	Graded	Bladed
360.38	97.47	12.4	327.49	79.24	38.72

Sources: Phillips County and Valley County 911 mapping systems

3.10.3 BLM Roads

The BLM maintains a number of roads within the BNGPA, totaling 861.59 miles. These roads all have gravel or native-material surface.

3.10.4 Roads on Private Lands

A variety of private and Operator-developed/maintained roads and two-tracks on private lands provide access from county and BLM roads to wells and ancillary gas-field facilities. Operator roads have been specifically developed to access wells, pipeline corridors, compressor stations, and other well field facilities. In most cases these roads are two-track roads. Private roads are existing roads used by private land-owners, typically for range and cropland access. In some cases these existing roads provide access to natural gas wells and ancillary facilities. In some areas, two-track roads have proliferated as short-cuts to wells and facilities have developed. In all, roads on private lands total an estimated 1,597.83 miles within the BNGPA.

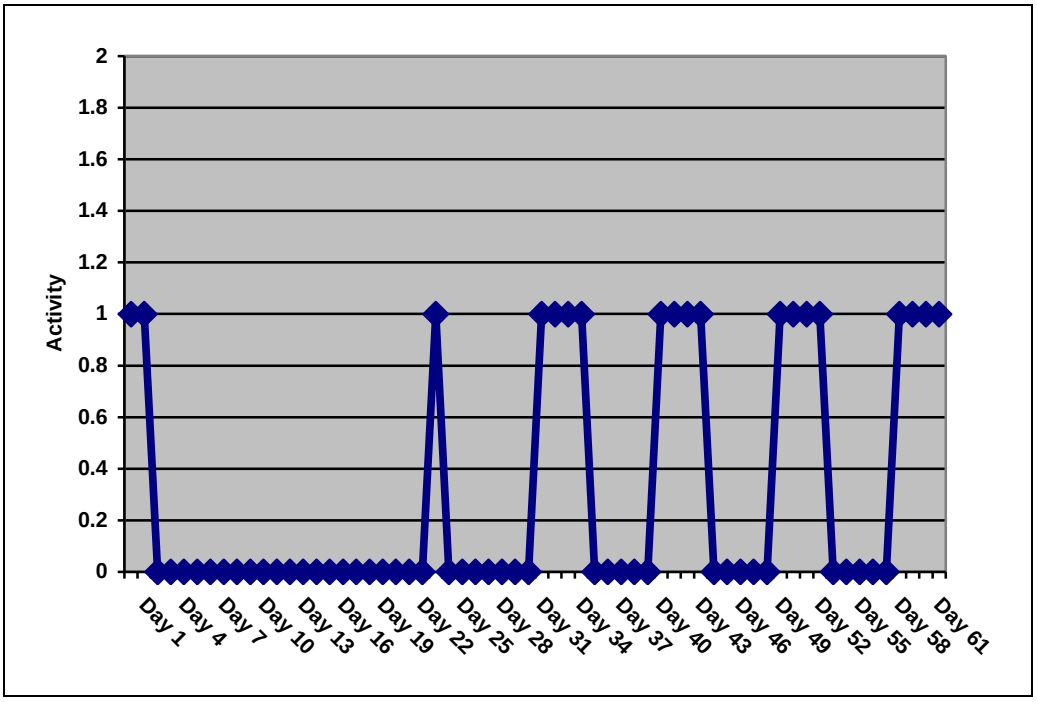
3.10.5 Current Natural Gas Drilling/Field-Development and Operations Traffic

Natural gas-related traffic within the BNGPA is associated with drilling, field development and operations.

Drilling/field-development includes well drilling and completion, gathering system construction, and occasional ancillary facility construction such as compressor stations, trunklines, roads and electrical power lines. Most drilling/field-development traffic occurs during July through November of each year.

Figure 3.10-3 displays the typical number of days that activity occurs on-site for a well completed in three zones. As shown in the figure, periods of fairly intensive activity for drilling (2 days), closed-hole logging (one day), completion (four days per zone) and installation of surface facilities and bringing the well on line (four days) are interspersed with periods of no activity at the well site.

Figure 3.10-3. Typical Days of Well Site Activity for a BNGPA Well Completed in 3 Zones



Source: FEPC 2006

Much of the large equipment for drilling and field development such as drilling rigs and pipeline construction equipment mobilizes to the BNGPA in July and remains within the area for the duration of that year's drilling/field-development season. Trips for transport of crews, supplies, and fuel, and for pipe, well site, and pipeline equipment occur on a regular basis for the duration of the drilling season. Drilling/field-development trips to the BNGPA occur on federal and state highways throughout the season. Trips within the BNGPA to well and pipeline work sites occur throughout the season and are localized, centered on that year's drilling targets. Consequently, although drilling and field development traffic is temporary and short-term, a substantial amount of traffic can occur on individual county, BLM, and private roads when adjacent wells within a lease are being drilled. Short-term, temporary periods of relatively high traffic volumes can also occur during construction of ancillary facilities such as compressor stations. Again, these periods typically last for a matter of months.

During gas-field operations, traffic volumes are substantially lower than during drilling/field-development but occur year-round and are dispersed throughout the BNGPA. Traffic-generating activities during operations primarily involve well, pipeline and compressor station operations and maintenance. Fieldmen, also known as pumpers, visit between 10 and 15 wells per day. They visit each well on a schedule ranging from twice each week to once every two weeks, depending on the well and the individual Operator's maintenance program. Wells that require off-site disposal of water comprise about 25 percent of the wells in the BNGPA. Typically a water hauler will collect produced water from two to five wells per day and make two trips to a produced-water disposal pond. Compressor stations are also visited several times per day.

3.10.6 BLM Road Standards

A Transportation Plan and the Surface Operations Section of the Master APD for Phillips County and all fields/units/leases (federal) west of Hinsdale in Valley County (USBLM undated) govern road and access issues in the BNGPA. The Plan and APD requirements include the following:

<u>Maintenance of Existing Roads</u>

- Guidelines for maintenance of existing roads, including repair of safety and erosion problems on roads and road features (culverts, ditches, water turnouts, etc.)
- Landowner concurrence for work on lease roads on private and state surface
- Snow removal
- Road closure

<u>Construction of New Roads</u>

- Operators are highly encouraged to establish working relationships with land-owners. In situations on private lands where new roads are built or old roads are reconstructed, written permission will be needed from the private land-owner.
- Future and systematic development of a transportation network that serves all Operators in north Phillips County may involve requiring Operators to look at locating roads with the philosophy of 'one road in / one road out' of each well location. This philosophy is an attempt to eliminate or curtail the 'spider-web roads' that are being made in the affected areas.
- New roads on level or nearly level ground will not be bladed unless required by the GFFS Supervisor. Once these roads are established, the Operator will be required to use these roads/trails for access. The Operator may also be responsible for drainage as specified by GFFS Supervisor. Shortcutting of roads/trails will not be allowed. Any

Operator found to be shortcutting established roads/trails will be required to obliterate the trail and compensate the private land-owner for damage.

- Road junctions will be located where sight distances are adequate for safe entry and exit. All turns, including junctions, will have radii large enough to handle anticipated truck traffic for both drilling and production. Maximum grades will generally not exceed 10 percent except for pitch grades (i.e. road sections less than 300 feet).
- When new access roads have sustained maximum grades steeper than 10 percent, on sections longer than 300 feet, or where roads cross side slopes steeper than 25 percent, the Operator will consult with the Lewistown Field Office Civil Engineer under advisement of the GFFS Supervisor. If deemed necessary, the Operator will secure the services of a licensed professional engineer to design a safe, stable road. Vertical alignment diagram, cross-sections and other engineering studies may be completed as necessary to assure sound engineering practices and proper road construction.

3.11 VEGETATION

The BNGPA lies within the EPA Level III Northwestern Glaciated Plains, Omernik Ecoregion 42 (Omernik 1987). This ecoregion is a transitional region between the generally more level, moister, agricultural Northern Glaciated Plains to the east and the generally drier Northwestern Great Plains to the west and southwest (EPA 2002). Montana is the only western state in which Ecoregion 42 occurs; encompassing approximately 37,000 square miles (95,830 km^2) in the north-central and northeastern portions of the state. Key environmental factors that govern the structure of plant communities in this ecoregion are climatic variation (particularly drought cycles), fire suppression, and herbivory. The northern portion of the BNGPA, especially north of the Milk River in Phillips County, includes a moderately high concentration of semi-permanent and seasonal wetland depressions, locally referred to as prairie potholes. This particular area has been further divided into an EPA Level IV ecoregion (42m–Cherry Patch Moraines) that extends to the International Boundary between the U.S. and Saskatchewan, Canada (Figure 3.11-1).

3.11.1 Vegetation Communities

Prairie potholes, short- and mid-grass prairie, and shrublands comprise the majority of vegetation communities within the BNGPA (Figure 3.11-2). Prairie potholes form in small, shallow glacial depressions, are ephemerally flooded, and usually are less than one acre in size (Jones 2003). Vegetation associated with the prairie potholes is structured primarily along a hydrological gradient and occurs as concentric zonal bands, depending on the relative period of inundation. Drier, temporarily flooded potholes are dominated by western wheatgrass (*Pascopyrum smithii*), and needle spikerush (*Eleocharis acicularis*). As the inundation period becomes longer and wetlands become seasonally flooded, foxtail barley (*Hordeum jubatum*) and common spikerush (*Eleocharis palustris*) become dominant. Prairie potholes receiving saline groundwater or located in more alkaline soils often are dominated by salt tolerant species including Nuttall's alkaligrass (*Puccinellia nuttalliana*), saltgrass (*Distichlis stricta*), spangletop (*Scolochloa festucacea*), and three-square bulrush (*Scirpus pungens*).

Native upland vegetation in the BNGPA is a mix of short- and mid-grass prairie communities intermixed with shrub steppe (Figure 3.11-2). Steppe vegetation is the result of a semi-arid continental climate where highly variable precipitation favors shallow-rooted, herbaceous perennial grasses and deep-rooted shrubs over forests or woodlands. Between 1905 and 1972, total annual precipitation at Malta ranged from 7.4 inches in 1956 to 22.4 inches in 1927 with an

average of 12.7 inches per year (WRCC 2006). (Station metadata for Malta, NCDC COOP Station, is from 1 May 1905 to 31 May 1972). Shrub steppe vegetation in the area is characterized by open stands of plains silver sagebrush (*Artemisia cana* ssp. *cana*) with an herbaceous understory dominated by western wheatgrass, blue grama (*Bouteloua gracilis*), or needle-and-thread (*Hesperostipa comata*). Co-occurrence of short- and mid-grass prairies also is due to climatic variability. Shorter, drought-resistant species such as blue grama increase in abundance during periods of drought. Mid-grasses such as the rhizomatous western wheatgrass, bunch-forming prairie junegrass (*Koeleria macrantha*), and needle-and-thread, increase under more favorable, moister conditions (Jones 2003). Various shrubs and half-shrubs may occur within the BNGPA depending on chemical and physical properties of parent soils. Common species include Wood's rose (*Rosa woodsii*), rabbitbrush (*Ericameria* [formerly *Chrysothamnus*] *nauseosus*), greasewood (*Sarcobatus vermiculatus*), fringed sage (*Artemisia frigida*) and to a lesser extent western snowberry (*Symphoricarpos occidentalis*).

3.11.2 Vegetation Types

Plains silver sagebrush is the most common sagebrush taxa found throughout BNGPA, with big sagebrush (*Artemisia tridentata*) being more prevalent in the Saco or Larb Hills area. Silver sagebrush is a native perennial usually found growing on loamy and sandy soils. Silver sagebrush is capable of reproducing by seeds and re-sprouting from roots when top growth is destroyed allowing for a fairly rapid regeneration period (Whitson et al. 1992). Big sagebrush also is a native perennial shrub; however, reproduction is limited to seed production and the plants do not re-sprout following top-growth removal. Big sagebrush regeneration may take 50 to 75 years on harsher, more xeric sites. Consequently these two taxa are treated differently in reclamation efforts and are subject to a Condition of Approval when they are disturbed on BLM-administered lands.

Riparian vegetation in the BNGPA has been surveyed and described by the Montana Natural Heritage Program (MTNHP; Jones 2003). In general, riparian habitats along the Milk River are characterized by oxbow marshes, shrub-dominated terraces, and cottonwood gallery forests dominated by plains cottonwood (*Populus deltoides*), although narrowleaf cottonwood (*Populus angustifolia*) also is common (Jones 2003). Cottonwood stands range from open-canopy woodlands to closed-canopy forests. More mesic floodplain stands can be lush, with a well-developed and diverse shrub and small tree sub-canopy including box elder (*Acer negundo*), peachleaf willow (*Salix amygdaloides*), red-osier dogwood *(Cornus sericea*), yellow willow (*Salix lutea*), chokecherry (*Prunus virginiana*), western snowberry, Wood's rose, and silver buffaloberry (*Shepherdia argentea*; Jones 2003). Other riparian vegetation types include marsh communities associated with back channels and oxbows, including species such as broadleaf cattail (*Typha latifolia*) and hardstem bulrush (*Schoenoplectus acutus*). In addition, shrub communities associated with terraces support stands of plains silver sagebrush with an herbaceous layer dominated by western wheatgrass, and, on more alkaline sites, black greasewood with an herbaceous layer of saltgrass (Jones 2003).

Diversity of riparian and wetland-associated species is greater than upland-associated species based on a comparison of obligate and facultative species within Phillips and Valley counties (MTNHP 2007). All but one plant species listed as BLM Sensitive or Proposed Sensitive, and the one Plant Species of Concern are associated with wetland/riparian habitats (Table 3.11-1).

Figure 3.11-1. Topography and EPA Level III and IV Omernik Ecoregions Within the BNGPA

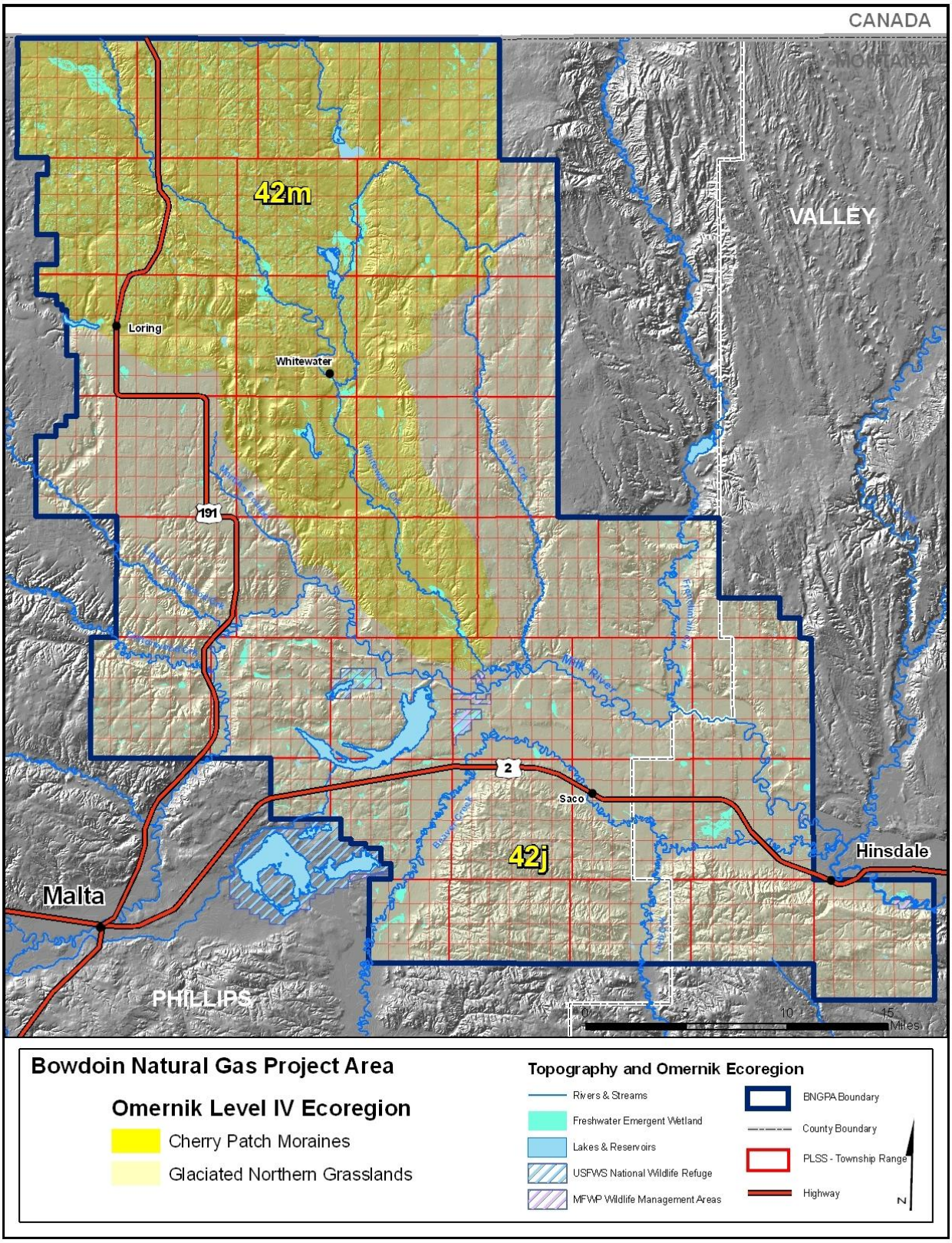
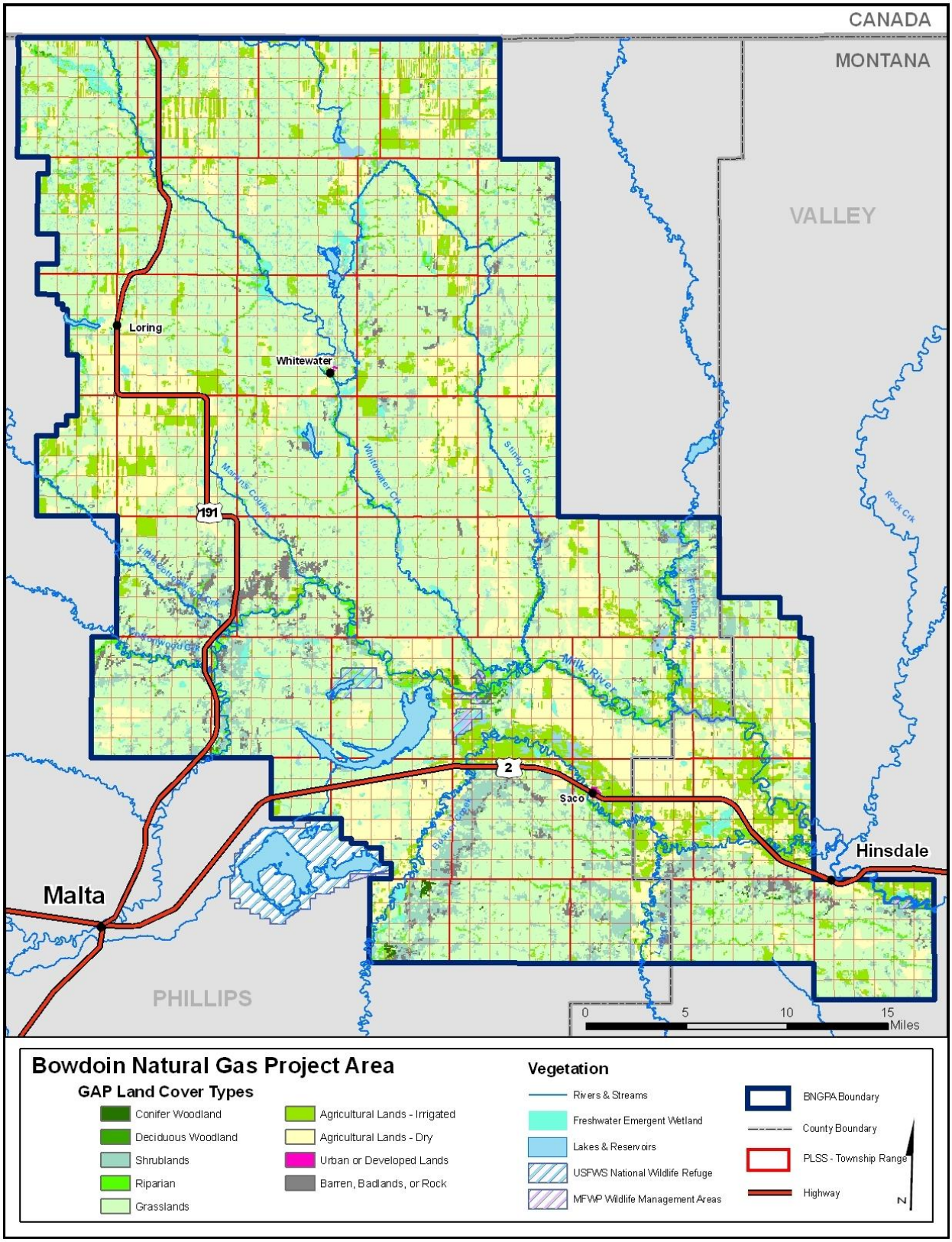


Figure 3.11-2. GAP Vegetation Land Cover Types Within the BNGPA



3.11.3 Wetland and Riparian Areas

According to National Wetland Inventory data, approximately 33,683 acres of wetlands occur within the BNGPA (Table 3.11.3-1). The vast majority of wetlands are comprised of temporarily, seasonally, and semi-permanently flooded freshwater emergent wetlands (palustrine, emergent [PEM]; Cowardin *et al.* 1979). Over 16,000 of these emergent wetland habitats are scattered across the BNGPA landscape—the majority concentrated in the Cherry Patch Moraines ecoregion north of the Milk River Valley. Several large lakes, including Nelson Reservoir, Whitewater Lake, and Pea Lake, constitute approximately 75 percent of lacustrine habitats within the BNGPA. Freshwater ponds and perennial and intermittent riverine habitats make up much of the remaining wetland surface acreage (Table 3.11.3-1). Other wetland habitats, including freshwater forested and scrub-shrub wetlands, also occur within the BNGPA but cover a much smaller proportion of total wetland area. The total surface area of all wetland habitats represents slightly more than four percent of the 812,389-acre BNGPA.

Table 3.11-1. Acreage and Proportion of Wetlands Within the BNGPA

General Wetland Description[1] • Water Regime	N	Acres	% of BNGPA Wetlands	% of BNGPA
Lakes	36	6,618	19.6	0.81
Freshwater ponds	1,145	2,296	6.8	0.28
Freshwater forested/shrub wetlands	93	174	0.5	0.02
• Temporarily flooded	85	161	0.5	
• Seasonally flooded	8	13	0.0	
Freshwater emergent wetlands	16,032	21,610	64.2	2.66
• Temporarily flooded	11,938	14,521	43.1	
• Seasonally flooded	3,972	6,280	18.6	
• Semipermanently flooded	122	810	2.4	
Other wetlands	139	552	1.6	0.07
• Temporarily flooded	120	533	1.6	
• Seasonally flooded	19	19	0.1	
Riverine	107	2,434	7.2	0.30
• Intermittent	75	1,128	3.3	
• Perennial	32	1,306	3.9	
TOTAL	**17,552**	**33,683**	**100.0**	**4.15**

[1] Wetland habitat classifications (Cowardin *et al*. 1979) include: lakes (L2ABF, L2ABG, L2UBG, L2USA, L2USC); freshwater ponds (PABF, PUBF, PUBG); freshwater forested/shrub (PFOA, PFOC, PSSA, PSSC); freshwater emergent (PEM/USA, PEMA, PEMC, PEMF); other (PUSA, PUSC); and riverine (R2UBG, R2USA, R2USC, R4USA, R4USC, R4USF).

Generally, wetlands are defined as lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin *et al.* 1979). Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors, including human disturbance. For regulatory purposes under the Clean Water Act (CWA), the term wetlands means "*those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil*

conditions. Wetlands generally include swamps, marshes, bogs and similar areas [EPA Regulations listed at 40 CFR 230.3(t)]." To distinguish between the two major wetland ecosystems most often encountered in the semi-arid West, the terms lotic and lentic are commonly used.

Lotic wetlands are associated with running-water systems such as rivers, streams, and drainageways. Such wetlands contain a defined channel and floodplain. The channel is an open conduit which periodically or continuously carries flowing water with dissolved and suspended material. Beaver ponds, seeps, springs, and wet meadows on the floodplain of, or associated with, a river or stream are part of the lotic wetland.

Lentic wetlands are associated with still-water systems. These wetlands occur in basins and lack a defined channel and floodplain. Included are permanent (e.g., perennial) or intermittent bodies of water such as lakes, reservoirs, potholes, marshes, ponds, and stockponds. Other examples include fens, bogs, wet meadows, and seeps not associated with a defined channel. The majority of wetlands in the project area would be classified as lentic wetlands.

3.11.3.1 Jurisdictional Wetland Criteria

Jurisdictional wetlands are those wet areas that are protected by law through §404 of the CWA and the Swampbuster Provision of the Food Security Act. Currently, jurisdictional wetlands in the United States are those that meet the criteria defined in the 1987 Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and part 513 of the National Food Security Act Manual (3rd Ed.). These are not inclusive of all wetlands incorporated in the classification of Cowardin et al. (1979). Jurisdictional wetlands, as defined by the COE 1987 Manual, must have the following general diagnostic environmental characteristics:

- **Vegetation**—The prevalent vegetation consists of macrophytes that are typically adapted to areas having hydrologic and soil conditions. Hydrophytic species due to morphological, physiological, and/or reproductive adaptation(s) have the ability to grow, effectively compete, reproduce, and/or persist in anaerobic soil conditions.
- **Soil**—Soils are present and have been classified as hydric, or they possess characteristics that are associated with reducing soil conditions.
- **Hydrology**—The area is inundated either permanently or periodically at-mean water depths $\leq$ 6.6 ft. or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation.

In addition to the above criteria, for a wetland to be considered jurisdictional, it must also have a connection to a Traditionally Navigable Water (TNW) or demonstrate a "significant nexus" to a TNW. While the definitions of a wetland are fairly straightforward, whether or not a wetland is jurisdictional under the CWA is not. Jurisdictional definitions have gone through a number of legal challenges, and those definitions have been refined and revised through agency and Court decisions. The most recent Supreme Court decisions affecting the CWA jurisdictional issue include: Solid Waste Agency of Northern Crook County (SWANCC v. U.S. Army Corps of Engineers, 531 U.S. 159 (2001), and the consolidated cases Rapanos v. United States and Carabell v. United States, presently referred to as simply Rapanos (Argued February 21, 2006—Decided June 19, 2006). The EPA and COE issued a memorandum providing guidance to EPA regions and U.S. Army Corps of Engineers districts on June 5, 2007, on implementing the Supreme Court's Rapanos decision.[2] If there is a question as to whether a wetland is

[2] Available at <www.usace.army.mil/cw/cecwo/reg/cwa_guide/rapanos_guide_**memo**.pdf>

jurisdictional or not, it should be considered jurisdictional or be otherwise indicated that the site has a high potential for jurisdictional status. If for some reason it is important to conclusively determine whether the site is jurisdictional or not, the COE should be contacted.

3.11.3.2 Functional Wetland Criteria

The biological, chemical, and physical operations and attributes of a wetland are known as *wetland functions*. Some typical wetland functions include wildlife habitat and food chain support, surface-water retention or detention, ground water recharge, and nutrient transformation. Distinct from these intrinsic natural functions are human uses of and interaction with wetlands. Society's utilization and appraisal of wetland resources are referred to as *wetland values*, which include support for commercially valuable fish and wildlife, flood control, supply of drinking water, enhancement of water quality, and recreational opportunities.

Functional definitions have generally been difficult to apply to the regulation of wetland dredging or filling. Although the intent of legislation is to protect wetland functions, delineation of jurisdictional wetlands has relied largely on structural features or attributes. The prevailing view among many wetland scientists is that functional wetlands need to meet only one of the three criteria as outlined by Cowardin *et al.* (1979) (e.g., hydric soils, hydrophytic plants, and wetland hydrology). On the other hand, jurisdictional wetlands need to meet all three criteria, except in limited situations. Even though functional wetlands may not meet jurisdictional wetland requirements, they certainly perform wetland functions resulting from the greater amount of water that accumulates on or near the soil surface relative to the adjacent uplands. Currently, many of these sites fail to meet jurisdictional wetland criteria. Nevertheless, these sites do provide important wetland functions and may warrant special managerial consideration.

Potential non-jurisdictional wetlands within the project area include the numerous “prairie potholes” on the glaciated plains of Phillips and Valley Counties. The Judith Valley Phillips RMP (1992) recognizes these potholes as wetland sites because they support vegetation “adapted for life in saturated soil conditions.” The typical pothole is not flooded every year, but when it is, it supports wetland vegetation (RMP, p. 117). If a non-jurisdictional prairie pothole is located on BLM-managed lands, it is subject to BLM jurisdiction and management.

3.11.3.3 Proper Functioning Condition

The BLM, as a land management agency, manages wetlands and riparian areas in accordance with BLM Land Health Standards (BLM 1995) to maintain their proper functioning condition (PFC). PFC is a qualitative method for assessing the condition of riparian wetland areas. The term PFC is used to describe both the assessment process and a defined, on-the-ground condition of a riparian/wetland area. This role is different from and not duplicative of the COE responsibility over jurisdictional wetlands. Hansen *et al*. (2000) point out that the current interpretation, at least in the western United States, is that not all functional wetlands are jurisdictional wetlands, but all jurisdictional wetlands are functional wetlands. The BLM Land Health Standards for riparian/wetland management provide for PFC when the following criteria are met (Prichard *et al.* 1994; Prichard *et al.* 1998):

Adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality;

- Conditions are present to filter sediment, capture bedload, and aid floodplain development;
- Conditions are present to improve flood-water retention and ground-water recharge;

- Conditions are present that favor the development of root masses that stabilize streambanks against cutting action; and
- Conditions are present that favor the development of diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses.

3.11.4 Invasive, Non-Native Species

Invasive and noxious weed species and their continued spread and establishment on private, state, and federal lands represent a serious threat to the long-term productivity, diversity, and aesthetic values of lands within the BNGPA as well as within the state of Montana. Executive Order (EO) 13112 ("Invasive Species") was signed by President W. J. Clinton on February 3, 1999. The primary purpose of this EO is to prevent the introduction of invasive species and minimize the economic, ecological, and human health impacts that invasive species cause.

The Montana County Noxious Weed Act (MCA §§7-2101 through 2153, enacted 1948, as amended) defines noxious weeds as plant species that are not indigenous to the state of Montana and meet at least one of several criteria regarding negative impacts on crops, native plant communities, livestock, and the management of natural or agricultural systems. This definition applies to species listed by both the state and local governing bodies (Table 3.11-2).

Noxious weed species recognized by Montana are grouped into three Noxious Weeds categories:

Category 1. Species in Montana that are currently established and are generally widespread in many counties of the state. Management criteria include awareness and education, containment and suppression of existing infestations, and prevention of new infestations. These weeds are capable of rapid spread and of rendering land unfit or greatly limiting beneficial land uses.

Category 2. Species that have been recently introduced into the state or are rapidly spreading from their current infestation sites. These weeds are capable of rapid spread and establishment, and render affected lands unfit for beneficial uses. Management criteria include awareness, education, and monitoring and containment of known infestations along with eradication where possible.

Category 3. Species that have not been detected in the state or may be found only in small, scattered, localized infestations. Management criteria include awareness, education, and immediate action to eradicate infestations. These species are known pests in nearby states and are capable of rapid spread and of rendering land unfit for beneficial uses.

Table 3.11-2. Montana Noxious Weed Species[1]

Common Name	Taxonomic Name	Common Name	Taxonomic Name
Category 1		**Category 2**	
Canada thistle	*Cirsium arvense*	Dyers woad	*Isatis tinctoria*
Common tansy	*Tanacetum vulgare*	Orange hawkweed	*Hieracium aurantiacum*
Dalmatian toadflax	*Linares dalmatica*	Perennial pepperweed	*Lepidium latifolium*
Diffuse knapweed	*Centaurea diffusa*	Purple loosestrife	*Lythrum salicaria*
Field bindweed	*Convolvulus arvensis*	Tall buttercup	*Ranunculus acris)*
Houndstongue	*Cynoglossum officinale L.*	Tamarisk [Saltcedar]	*Tamarix* spp
Leafy spurge	*Euphorbia esula*	Tansy ragwort	*Senecio jacobaea*
Oxeye daisy	*Chrysanthemum leucanthemum* L.	Purple loosestrife or lythrum	*Lythrum salicaria, L. virgatum,* and any hybrid crosses thereof
Russian knapweed	*Centaurea repens*	Meadow hawkweed complex	*Hieracium pratense, H. floribundum, H. piloselloides*
St. Johnswort	*Hypericum perforatum*	**Category 3**	
Spotted knapweed	*Centaurea maculosa*	Common crupina	*Crupina vulgaris*
Sulfur (Erect) cinquefoil	*Potentilla recta*	Eurasian watermilfoil	*Myriophyllum spicatum*
Whitetop or Hoary cress	*Cardaria draba*	Rush skeletonweed	*Chondrilla juncea*
Yellow toadflax	*Linaria vulgaris*	Yellow flag iris	*Iris pseudacorus*
		Yellow starthistle	*Centaurea solstitialis*

[1] Center for Invasive Plant Management

The most common weeds of concern within the BNGPA include spotted knapweed, diffuse knapweed, Russian knapweed, and leafy spurge. Canada thistle, houndstongue, and hoary cress also occur within the BNGPA, and are included in each county's weed control district treatment and monitoring plans. Any area of surface disturbance created by project-related activities is especially vulnerable to weed invasion and establishment.

Biological control of leafy spurge using *Aphthona lacertosa* beetles in sensitive and riparian areas was initiated by the BLM Glasgow Field Station and the Valley County Weed District in the early 1900s. Results to date are encouraging, and time-series photographs depicting changes at various treatment locations are striking (BLM 2007). The Malta Field Office and the Phillips County Weed District have used this procedure from 2000 to 2007 for leafy spurge *(Apthonia nigriscutis)*, spotted knapweed *(Larinus obtusus)* and Canadian thistle *(Ceutorhynchus litura)*.

3.12 WILDLIFE

3.12.1 Introduction

The BNGPA is located within the BLM – Malta Field Office. The project area comprises approximately 14 percent of the 5.8 million acres within the field office. Objectives for wildlife management in the field office are directed by the ROD of the Judith Valley Phillips RMP (BLM 1994). The RMP provides for multiple-use planning and management of public lands and resources in a combination designed to meet present and future needs. Information concerning

current and historical wildlife observations and distribution were obtained from various sources. Location and occurrence records for vertebrate species within and nearby the BNGPA were obtained from the MTNHP, and information compiled from personal communications and unpublished data from BLM, MFWP, and USFWS biologists. The MTNHP website (www.mtnhp.org) is one of the primary repositories of wildlife observation and distribution information for Montana. In addition, avian observation records are maintained on the Montana Bird Distribution Database website (http://nhp.nris.mt.gov/mbd). Information from annual Breeding Bird Surveys (www.mbr-pwrc.usgs.gov/bbs) and Christmas Bird Counts (www.audubon.org/bird/cbc) provided additional species occurrences.

3.12.2 Wildlife Habitat

A wide variety of wildlife habitats and their associated species occurs in the BNGPA. Wildlife habitats that could be affected by the project include the areas that would be physically disturbed by the construction of gas wells, related roads, pipelines, and production facilities, as well as zones of influence surrounding them. Zones of influence are defined as those areas surrounding or associated with project activities where impacts to a given species or its habitat could occur. The shape and extent of such zones varies with species and circumstances.

The BNGPA is located in the Northwestern Glaciated Plains Omernik Level III Ecoregion and includes portions of the Cherry Patch Moraines and Glaciated Northern Grasslands Level IV Ecoregions (Woods et al. 2002; Figure 3.11-1). Topography in the BNGPA varies from level, rolling prairie to steep, irregularly dissected plains broken by moraines, rocky knolls, gravelly ridges, and coulees. Short-grass prairie habitat predominates throughout the BNGPA with shrubs mostly restricted to moist depressions. Seventy-five percent of the BNGPA is “critical native prairie wildlife habitat” (Gunderson 2006). The northern portion of the BNGPA is pocked with a high concentration of semi-permanent and seasonal wetlands or prairie potholes. Cottonwoods and riparian habitat are found in the southern portion of the BNGPA along the Milk River, Cottonwood Creek, Little Cottonwood Creek, Stinky Creek, and Frenchman Creek; otherwise, trees are rare. Several large lakes and reservoirs in and nearby the BNGPA provide an array of lacustrine and wetland habitats. Bowdoin National Wildlife Refuge (NWR), located southwest of the BNGPA, consists of over 15,000 acres of resting, feeding, and breeding habitat for migratory birds and wildlife. Over 7,000 acres of Bowdoin NWR support saline and freshwater wetlands. Additional protected wetlands exist in the 1,677- acre Hewitt Lake NWR which is located within the BNGPA and is administered from Bowdoin NWR. Detailed descriptions of vegetation types within the BNGPA are provided in section **3.11**, **Vegetation**.

3.12.3 General Wildlife

At least 342 wildlife species occur in and around the BNGPA including 47 mammal species, 280 bird species (**Appendix B**), and 15 species of amphibians and reptiles. All wildlife species are important members of a functioning ecosystem and wildlife community, but most are common and have wide distributions in the region. Consequently, the relationship of most of these species to the proposed project are not discussed in the same depth as species that are threatened, endangered, rare, of special concern, of special economic interest, or are otherwise of high interest or unique value.

3.12.4 West Nile Virus

The USDA Centers for Disease Control and Prevention (CDC) states that West Nile Virus (WNV) is a mosquito-borne disease that can cause encephalitis and other brainstem diseases

in humans and may impact certain vertebrate wildlife populations. WNV is spread when mosquitoes feed on infected birds, then on people, other birds and animals. WNV is not spread by person-to-person contact, and there is no evidence people can contract the virus by handling infected animals (CDC 2006). Currently the CDC has identified 43 mosquito species that may transmit the virus. Many of those species are common to Montana (e.g., *Culex tarsalis*)(CDC 2006). WNV has been detected in dead birds of at least 138 species. Although birds, particularly crows and jays, infected with WNV can die or become ill, most infected birds do survive (CDC 2006). Greater sage-grouse are very susceptible to WNV (F. Prellwitz, BLM, unpublished data).

Mosquitoes can potentially breed in any standing water that lasts for more than four days. As the number of wells increases, the amount of produced surface water will increase. Unless measures are taken to make evaporation pits unattractive mosquito breeding habitat, an increase in surface water has the potential to increase mosquito breeding habitat, mosquitoes, and incidences of WNV.

In Montana, the first confirmed case of the disease was found in a horse in 2002. Since then, the state has had a total of 262 confirmed cases of WNV in humans, resulting in four deaths, and 349 cases in horses, with 98 deaths (Montana Department of Public Health & Human Services 2006). The risk of receiving a bite by an infected mosquito increases with work that requires being outdoors (e.g., construction and equipment operators, laborers, well tenders, etc.). The risk is also increased in areas such as Phillips and Valley counties where prairie potholes, ponds, lakes, reservoirs, and rivers are numerous and irrigation is common.

Research is continuing on the relation of WNV and wildlife populations by the Wyoming Veterinary Lab, Montana State University, University of Montana, USDA, and the University of Alberta.

3.12.5 Big Game Species

Six big game species have the potential to occur in the BNGPA, including pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), elk (*Cervus elaphus*), moose (*Alces alces*), and bison (*Bos bison*). Pronghorn, mule deer, white-tailed deer, and elk populations are managed by the MFWP within areas designated as hunting districts or management units. The BNGPA has traditionally supported higher-than-average densities of pronghorn, mule deer, and white-tailed deer (Gunderson 2006). In addition, moose and bison potentially can occur in the BNGPA as they move south across the international border from adjacent Grasslands National Park (NP) in Canada. A rapidly expanding moose presence in the BNGPA has been noted in recent years (D. Prellwitz, BLM, personal communication). In addition, recent releases of wild bison in Grasslands NP raise the potential for their occurrence in the BNGPA from dispersal through livestock fences into the Frenchman Creek Breaks (D. Prellwitz, BLM, personal communication).

Pronghorn is the most abundant big game species within the BNGPA. The BNGPA is located in MFWP Region 6 and includes parts of Antelope Hunting Districts 600, 620, 630, and 670. The BNGPA provides year-round habitat for resident pronghorn and vital winter habitat for pronghorn that migrate south from Canada (Gunderson 2006, Sullivan 2006). Approximately 18.5 percent of the BNGPA is classified as winter/year-round pronghorn range, primarily located in the southern portion of the BNGPA around the Milk River (BLM, unpublished data; Figure 3.12-1). The remainder of the BNGPA is classified as year-round pronghorn range (MFWP 2002; Table 3.12-1). Ten pronghorn counting units (CU) are partially or entirely within the BNGPA (Gunderson 2006). Count data collected over the last 20 years indicates that six of the

10 CUs have pronghorn densities 40 percent higher than the regional average (Gunderson 2006).

Mule Deer are common year-round residents within the BNGPA. The BNGPA is located in MFWP Region 6 and includes parts of Deer Hunting Districts 611, 620, 630, and 670. Approximately 27.6 percent of the BNGPA is classified as winter/year-round range (BLM, unpublished data; Figure 3.12-2). The remainder of the BNGPA is classified as year-round mule deer range (MFWP 2004; Table 3.12-1). Rough terrain along Cottonwood Creek, Little Cottonwood Creek, and Frenchman Creek, and near Conservation Reserve Program (CRP) lands provides winter habitat for resident and migrant mule deer populations (Sullivan 2006). Trend data collected over the last 20 years indicates that mule deer winter at extremely high densities in the Frenchman Creek drainage (D. Prellwitz, BLM, unpublished data; Gunderson 2006). Radio-collar data reveals that many mule deer travel up to 50 miles to these wintering areas (Gunderson 2006).

White-tailed Deer are quite common year-round residents within the BNGPA where suitable habitat exists. The BNGPA is located in MFWP Region 6 and includes parts of Deer Hunting Districts 611, 620, 630, and 670. White-tailed deer are distributed across over 30 percent of the BNGPA, primarily along the Milk River, and various tributaries including Cottonwood Creek, Little Cottonwood Creek, Whitewater Creek, Stinky Creek, and Frenchman Creek (MFWP 1996; Table 3.12-1, Figure 3.12-3). White-tailed deer occur in small pockets in the northern portion of the BNGPA in CRP lands and shelter belts found primarily on private land (Sullivan 2006). MFWP annually conducts a white-tailed deer trend survey along the Milk River in the BNGPA, and data collected over the last 20 years indicate population densities at nearly 50 deer per square mile (Gunderson 2006).

Elk are uncommon within the BNGPA. The BNGPA is located in MFWP Region 6 and includes parts of the Hi-Line and Missouri River Breaks Elk Management Units. An isolated pocket of summer range is located around Rock Creek Canyon approximately three miles east of the BNGPA (MFWP 1999; Figure 3.12-1). Because elk habitat within the BNGPA is marginal, the MFWP does not intensively manage elk in the area, but concentrates most of its efforts to encourage elk use in the Missouri River Breaks (Sullivan 2006).

Moose are increasingly becoming more common and may be even more abundant than elk in the BNGPA. Moose dispersing across the border from Grasslands NP in Canada account for the majority of sightings in the BNGPA (Figure 3.12-4). The incidence of moose sightings has increased significantly since 2004 primarily along the Milk River. Moose are most likely to be found along the Milk River, Frenchman Creek, or Whitewater Creek where perennial water supports abundant riparian vegetation. Individual moose may remain in an area for up to several weeks, but the majority of moose dispersing into the BNGPA continue south toward the Missouri River or east to the Ft. Peck Indian Reservation. Dispersal might be the result of young animals looking for territories, or a result of disease organisms affecting the brain (D. Prellwitz, BLM, personal communication). Moose had not previously been hunted in the BNGPA. However, in order to limit the potential for spread of Chronic Wasting Disease from Saskatchewan to Montana, a recent Fish and Game Commission meeting in Helena approved two permits for moose in this area for the 2008 hunting season (Ibid.).

Bison were reintroduced in Saskatchewan, Canada, in May 2006 after being extirpated for 120 years. Seventy-two wild plains bison were released in the west unit of Grasslands NP where Frenchman River in Canada crosses the international border and becomes Frenchman Creek in the United States. No changes were made in the fence on the international border and any

bison might easily escape their fenced pastures and enter the United States (Figure 3.12-4). Bison in Montana would become the responsibility of the MFWP who would have no means of moving them back, other than allowing the animals to return on their own. BLM Wildlife Biologists and Technicians are already looking for bison in the Frenchman Breaks whenever they visit that area. A bison bull sighting north of Loring in April 1998 may have been an animal dispersing from other locations in Canada. Nevertheless, the origin of this bison remains unexplained.

Big Game Summary. Overall, the BNGPA is regularly used year-round by at least three big game species (i.e., pronghorn, mule deer, and white-tailed deer). The entire BNGPA is used by resident pronghorn and mule deer, and provides winter habitat for resident populations of these species as well as populations migrating south from Canada. Important habitat for mule deer, white-tailed deer, and wintering pronghorn exists along the Milk River and its tributaries in the central and southern portion of the BNGPA. MFWP has identified a small patch of elk summer range outside the BNGPA; however, regular use of the BNGPA by elk has not been documented or encouraged. Elk and moose sightings are sporadic and unpredictable within the BNGPA. Moose and bison sightings are likely to increase as animals from Grasslands NP disperse south into the BNGPA.

Table 3.12-1. Seasonal Ranges (acres) of Big Game Species Within the BNGPA

Species	Winter/Year-long	Year-long
Pronghorn	150,760	649,060
Mule Deer	223,870	624,120
White-tailed Deer	--	248,050

Figure 3.12-1. Seasonal Ranges of Pronghorn and Elk Within and Near the BNGPA

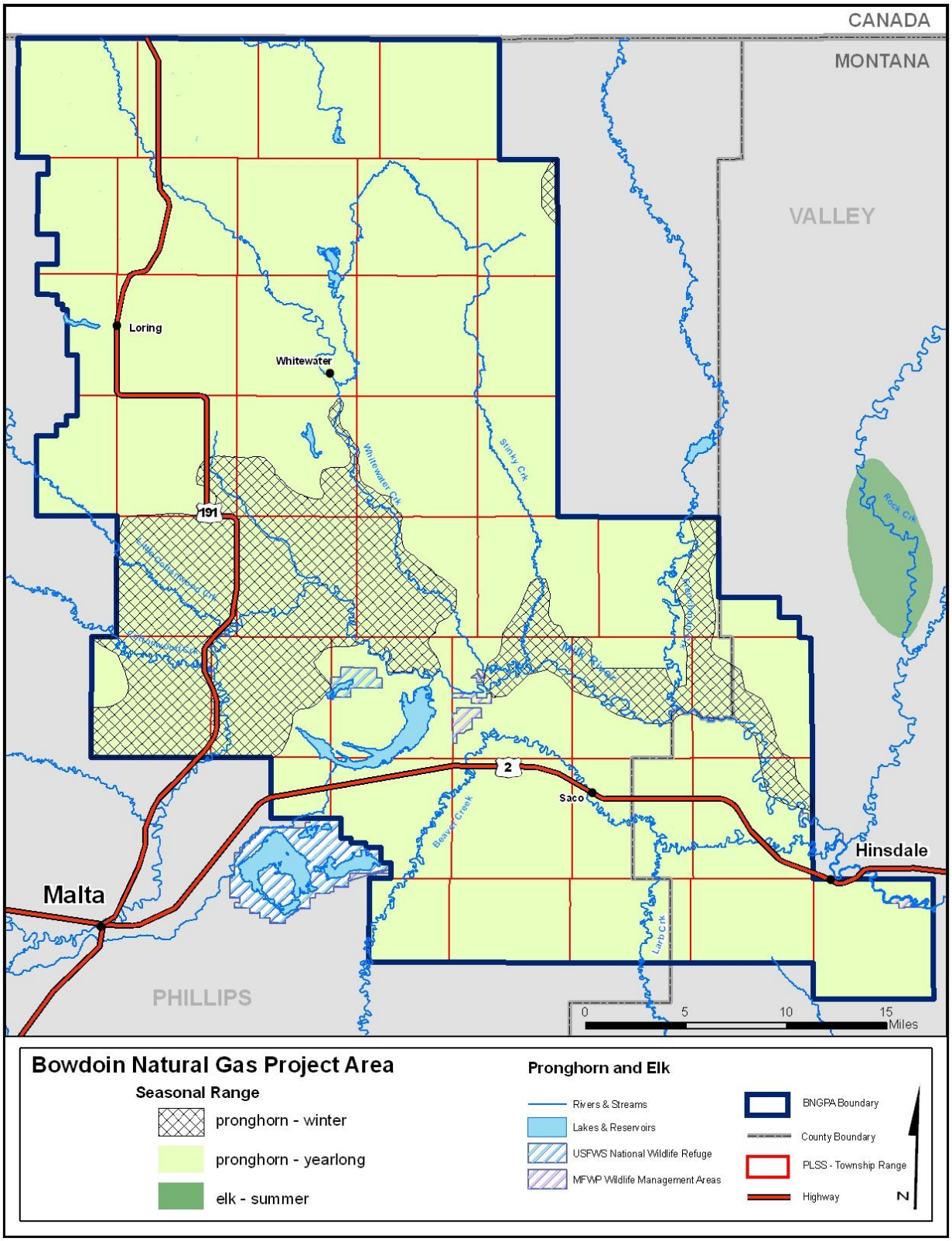


Figure 3.12-2. Seasonal Ranges of Mule Deer Within the BNGPA

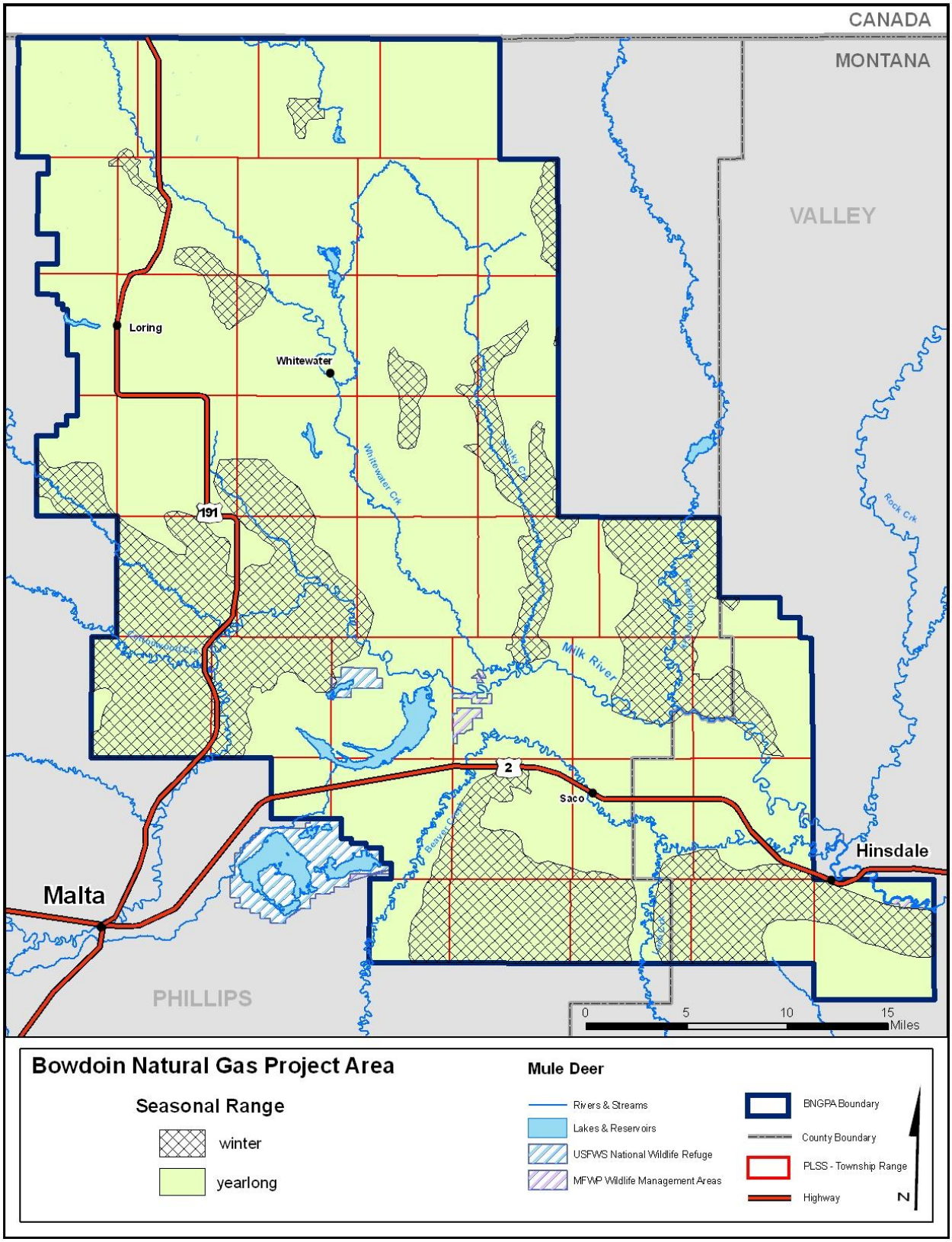


Figure 3.12-3. Range of White-tailed Deer Within the BNGPA

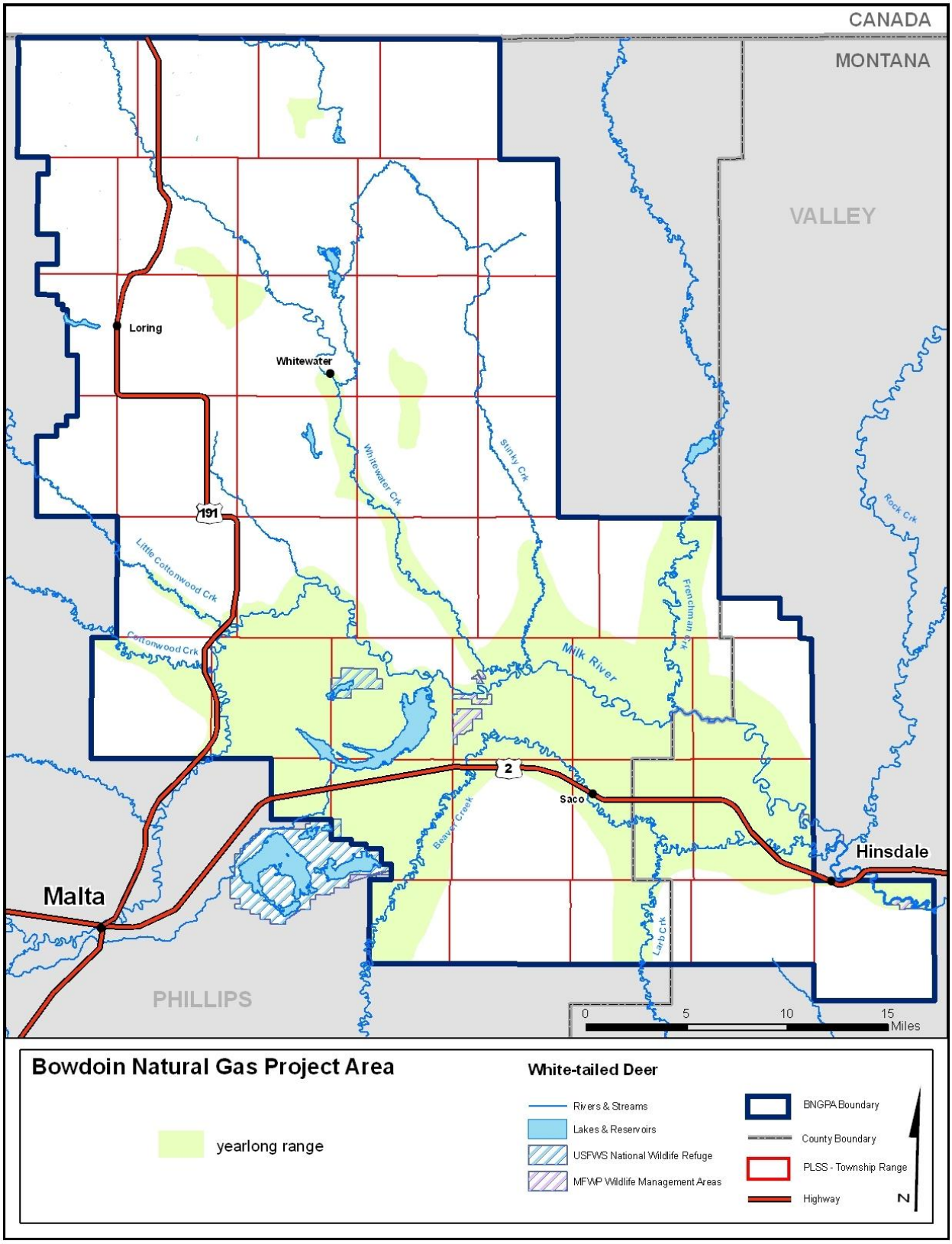
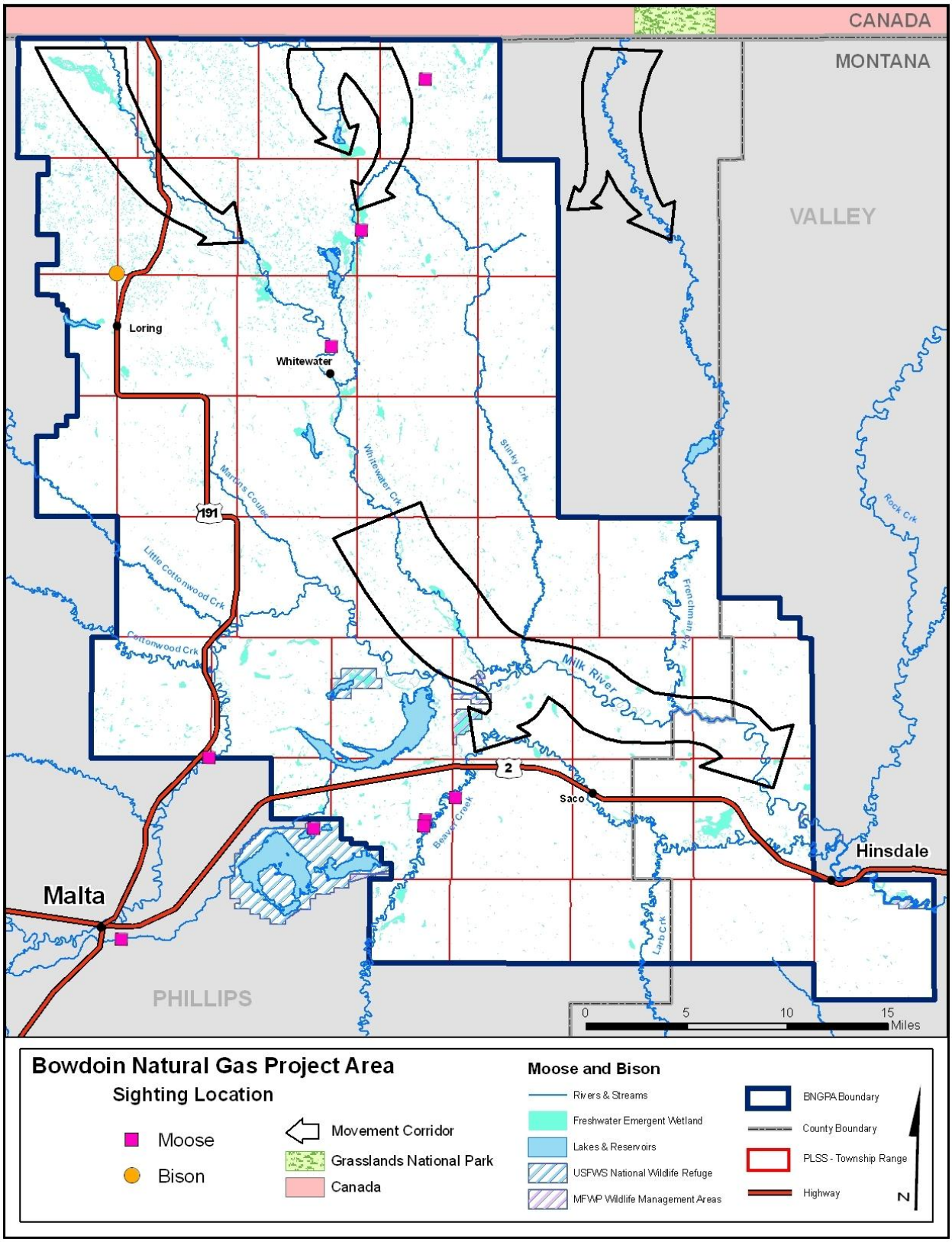


Figure 3.12-4. Locations and Potential Movement Corridors of Moose and Bison Within and Near the BNGPA



3.12.6 Upland Game Birds

Five upland game bird species occur in the BNGPA, including ring-necked pheasant (*Phasianus colchicus*), wild turkey (*Meleagris gallopavo*), gray partridge (*Perdix perdix*), sharp-tailed grouse (*Tympanuchus phasianellus*), and greater sage-grouse (*Centrocercus urophasianus*). Upland game bird populations in the BNGPA are managed by the MFWP Region 6.

Ring-necked Pheasant is a widely distributed, introduced upland game bird species primarily found in open grasslands and cropland habitats near riparian areas. Scattered trees and brushy cover along watercourses near grain crops are preferred habitat (MTNHP 2006*b*). Ring-necked pheasant are found all along the Milk River and its tributaries where suitable habitat exists (Sullivan 2006; Figure 3.12-5). Ring-necked pheasants frequently are found near gas wells in the Milk River Valley where they have adapted to living in proximity to human activities (D. Prellwitz, BLM, personal communication).

Wild Turkeys occur in open forest habitats with rugged terrain, grasslands, and brushy draws. Canyon bottoms and grain fields provide suitable fall and winter habitats. Wild turkeys occupy small pockets of habitat along the Milk River; however, wild turkey habitat in the BNGPA is marginal (Sullivan 2006; Figure 3.12-5). Wild turkeys occasionally are observed in the McNeil Slough and Cree Crossing areas north of Nelson Reservoir. More suitable habitat and higher population numbers occur outside the BNGPA along the Milk River below Hinsdale (Sullivan 2006).

Gray Partridge is an introduced upland game bird species and is common in mixed cultivated and non-cultivated habitats, often with patches of little bluestem grass. Grain fields interspersed with grasslands, weed patches, and brushy cover nearby provide escape and winter cover. Gray partridge populations are highly variable, but currently are relatively high in the BNGPA (Sullivan 2006).

Sharp-tailed Grouse primarily occupy grassland habitats with some shrub cover and access to brushy coulees and scattered trees. Sharp-tailed grouse are common within the BNGPA, and currently are exhibiting population numbers at or above management levels (Sullivan 2006; Figure 3.12-6). Sharp-tailed grouse are very common in the area north of the Milk River and in the Martin's Coulee area. An intensive aerial lek survey was conducted in the early 1980s (Grensten 1987). At least 107 leks were located within the BNGPA during the survey. Approximately 65 percent of the possible leks identified during aerial surveys in Phillips County were confirmed as active. The number of current leks probably has changed little since the 1980s, and although exact lek locations may have changed slightly in recent years, lek locations probably are in the same general areas. Forbs and insects are just as important as shrubs for providing sharp-tailed grouse food. Sharp-tailed grouse are less abundant near the Canadian border where shrub cover and rough topography is less common.

Greater Sage-grouse is a Montana Animal Species of Concern, and is designated as sensitive by the BLM. The species is discussed in detail in section **3.13**, **Special Status Wildlife, Fish, and Plants Species**.

Figure 3.12-5. Habitat of Ring-necked Pheasant and Wild Turkey Within the BNGPA

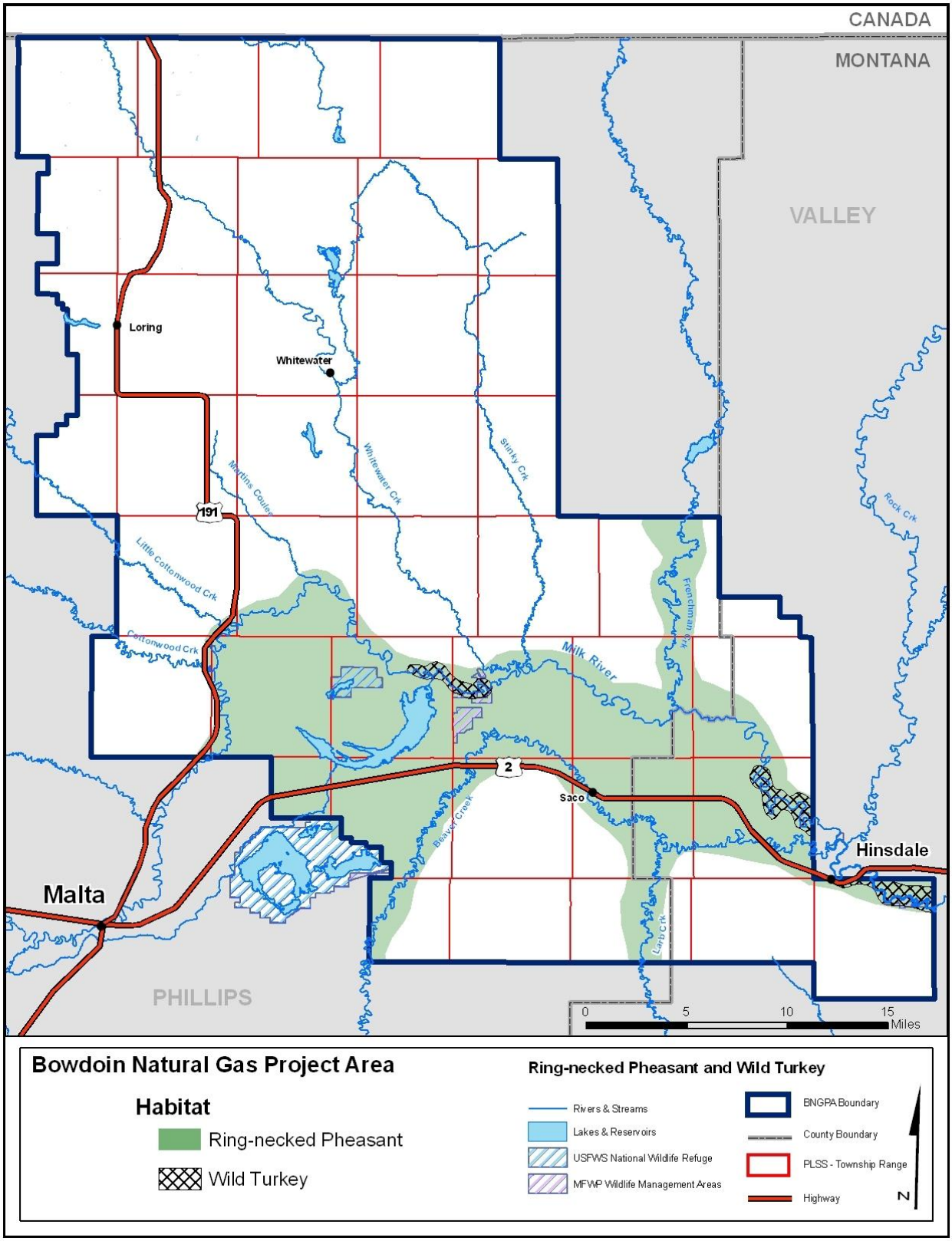
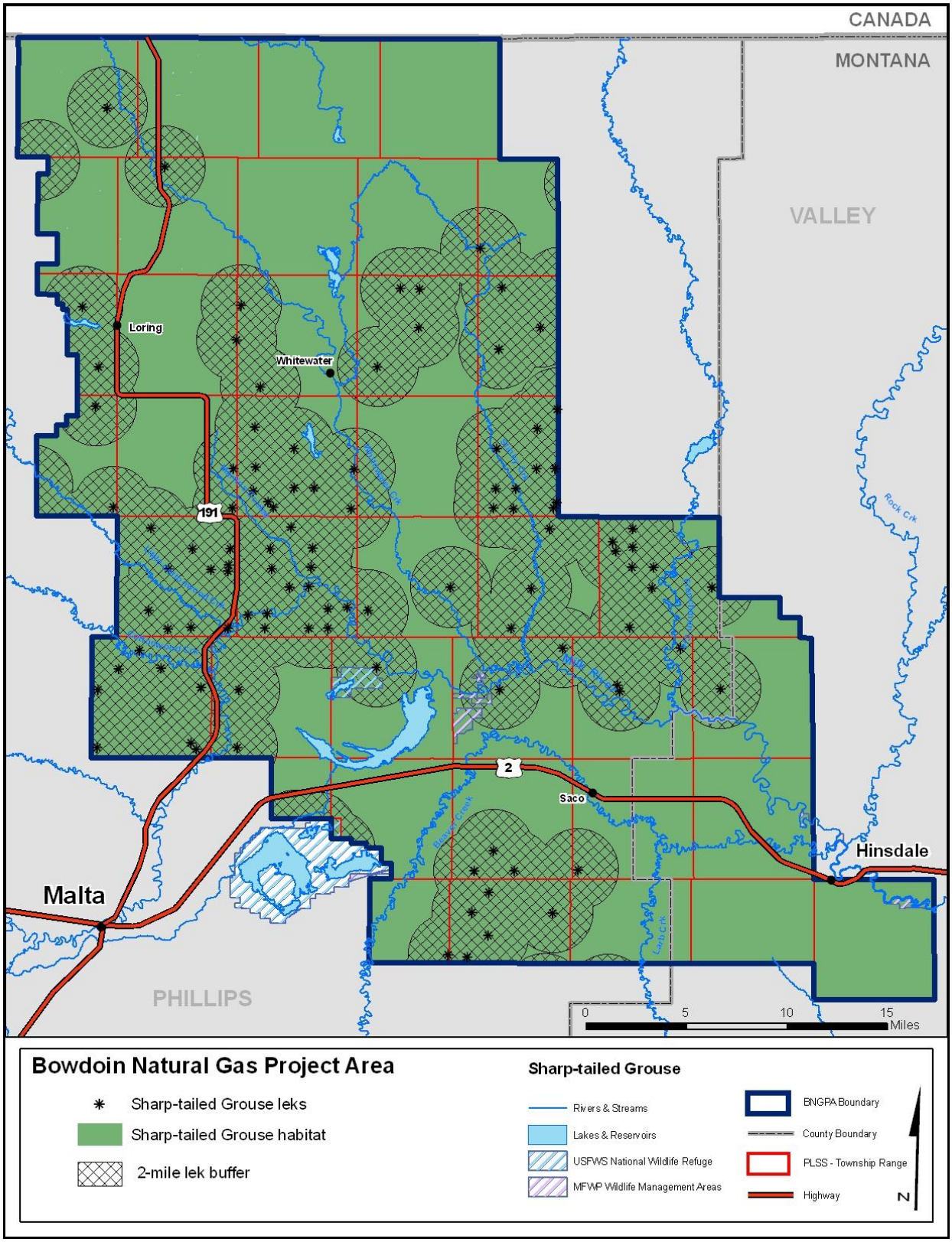


Figure 3.12-6. Habitat, Lek Locations, and Two-mile Lek Buffers of Sharp-tailed Grouse Within the BNGPA



3.12.7 Raptors

Twenty-five raptor species are known to occur in or around the BNGPA, including 13 that breed or potentially breed, three that over-winter, and nine that have been recorded as transients or migrants (Table 3.12-2). Seven species are designated as Montana Animal Species of Concern (MTNHP 2006*a*; Table 3.13-3), and are discussed in detail in section **3.13**, **Special Status Wildlife, Fish, and Plants Species**.

A variety of raptor breeding, hunting, and winter habitats occur within the BNGPA. Grasslands, shrublands, trees in riparian areas, and cliffs, rocky outcrops, and badland breaks all provide suitable nest substrates throughout the BNGPA; however, most species are found at low densities. The Milk River and other drainages that support trees and other riparian habitats (i.e., Cottonwood Creek, Little Cottonwood Creek, Stinky Creek, and Frenchman Creek, in particular) provide habitat for tree-nesting species and provide potential roosting sites for wintering raptors.

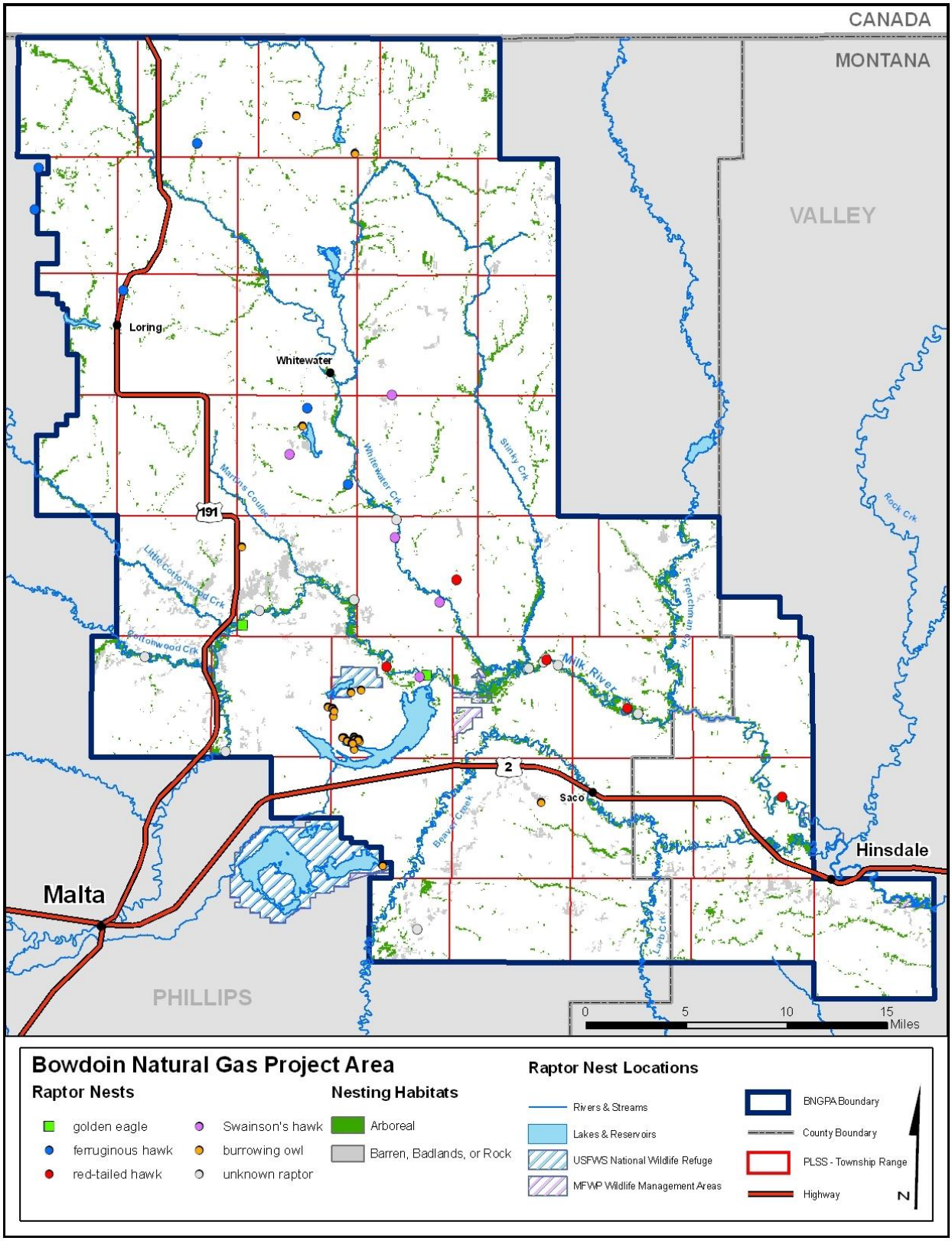
Wildlife biologist from the BLM, MFWP, USFWS, and Hayden-Wing Associates (HWA) have located at least 43 raptor nests belonging to five species in or within one mile of the BNGPA (HWA, unpublished data; BLM, unpublished data; Figure 3.12-7). In addition, biologists have located 12 unknown raptor nests within the BNGPA. The majority of nests are located in riparian areas or in cottonwoods scattered in upland areas. Most burrowing owl nests have been located in the prairie-dog colonies near Hewitt Lake and Nelson Reservoir. Turkey vultures are present throughout the summer within the BNGPA, and the population size has significantly increased in the past decade, especially around Nelson Reservoir (D. Prellwitz, BLM, personal communication).

Table 3.12-2. Occurrence Potential of Raptor and Vulture Species Within the BNGPA

Common Name[1]	Scientific Name	Occurrence Potential[2]
American Kestrel	*Falco sparverius*	pB
Bald Eagle*	*Haliaeetus leucocephalus*	t
Broad-winged Hawk	*Buteo platypterus*	t
Burrowing Owl*	*Athene cunicularia*	B
Cooper's Hawk	*Accipiter cooperii*	t
Eastern Screech-owl	*Otus asio*	B
Ferruginous Hawk*	*Buteo regalis*	B
Golden Eagle	*Aquila chrysaetos*	B
Great Horned Owl	*Bubo virginianus*	B
Gyrfalcon	*Falco rusticolus*	W
Long-eared Owl	*Asio otus*	B
Merlin	*Falco columbarius*	B
Northern Goshawk*	*Accipiter gentiles*	W
Northern Harrier	*Circus cyaneus*	B
Northern Saw-whet Owl	*Aegolius acadicus*	t
Osprey	*Pandion haliaetus*	t
Peregrine Falcon*	*Falco peregrinus*	t
Prairie Falcon	*Falco mexicanus*	B
Red-tailed Hawk	*Buteo jamaicensis*	B
Rough-legged Hawk	*Buteo lagopus*	W
Sharp-shinned Hawk	*Accipiter striatus*	t
Short-eared Owl	*Asio flammeus*	B
Snowy Owl	*Nyctea scandiaca*	W
Swainson's Hawk*	*Buteo swainsoni*	B
Turkey Vulture	*Cathartes aura*	t

[1] Special-status species indicated by asterisk.
[2] Occurrence potential of raptor species includes: known breeding (B); known to be present during breeding season and potentially breed (pB); known to over-winter (W); and known transient or migrant (t).

Figure 3.12-7. Location of Raptor Nests and Potential Arboreal, Cliff, and Badland Nesting Habitat Within and Immediately Adjacent to the BNGPA



3.12.8 Colonial Nesting Waterbirds

Colonial nesting waterbirds include species belonging to the following avian orders: Pelecaniformes (pelicans and cormorants), Ciconiiformes (herons, egrets, and ibises), and Charadriiformes (gulls and terns). Eared grebes are known to nest in large, dense aggregations in association with other colonial nesting species. They are discussed in this section although species in the order Podicipediformes (grebes) are not conventionally classified as colonial nesting waterbirds. Twenty-one species of colonial nesting waterbirds potentially could occur within or nearby the BNGPA (Reichel 1996, Feigley 1998, USFWS 1999, MBDD 2006*a*, *b*; Table 3.12-4). Fifteen species nest or potentially nest within or nearby the BNGPA, and all occasionally, if not regularly, feed within the BNGPA. Six species are rarely observed as transients or migrants. Nine colonial nesting waterbird species are designated Montana Animal Species of Concern due to their sensitivity to disturbance (MTNHP 2006*a*; Table 3.13-3), and are discussed in detail in section **3.13**, **Special Status Wildlife, Fish, and Plants Species**.

Table 3.12-3. Occurrence Potential and Preferred Wetland Type of Colonial Nesting Waterbird Species Within or Near the BNGPA

Common Name[1]	Scientific Name	Occurrence Potetial[2]	Wetland Type[3]
American White Pelican*	*Pelecanus erythrorhynchos*	b	L
Arctic Tern	*Sterna paradisaea*	pB, b	L
Black Tern*	*Chlidonias niger*	pB, b	M
Black-crowned Night-heron*	*Nycticorax nycticorax*	b	M
Bonaparte's Gull	*Larus philadelphia*	t	M
California Gull	*Larus californicus*	B, b	L
Caspian Tern*	*Sterna caspia*	B, b	L
Cattle Egret	*Bulbucus ibis*	t	M
Common Tern*	*Sterna hirundo*	B, b	L
Double-crested Cormorant	*Phalacrocorax auritus*	pB, b	L, M, R
Eared Grebe	*Podiceps nigricollis*	B, b	M
Forster's Tern*	*Sterna forsteri*	t	M
Franklin's Gull*	*Larus pipixcan*	b	M
Great Blue Heron	*Ardea herodias*	pB, b	R
Great Egret	*Ardea alba*	t	M, R
Herring Gull	*Larus argentatus*	t	L
Interior Least Tern*	*Sterna antillarum athalassos*	pB, t	L
Ring-billed Gull	*Larus delawarensis*	B, b	L, M
Sabine's Gull	*Xema sabini*	t	L
Snowy Egret	*Egretta thula*	pB, b	M
White-faced Ibis*	*Plegadis chihi*	b	M

[1] Special-status species indicated by asterisk.
[2] Occurrence potential of colonial waterbird species includes: known breeding colony within BNGPA (B); present during breeding season and potential breeding colony (pB) within the BNGPA; known breeding colony within Bowdoin NWR (b) just outside of the BNGPA; and known transient or migrant (t).
[3] Preferred general wetland type in Montana includes: large lakes, reservoirs, or rivers with islands, sparse vegetation (L); marsh complexes, small ponds with emergent vegetation (M); and riparian zone (R).

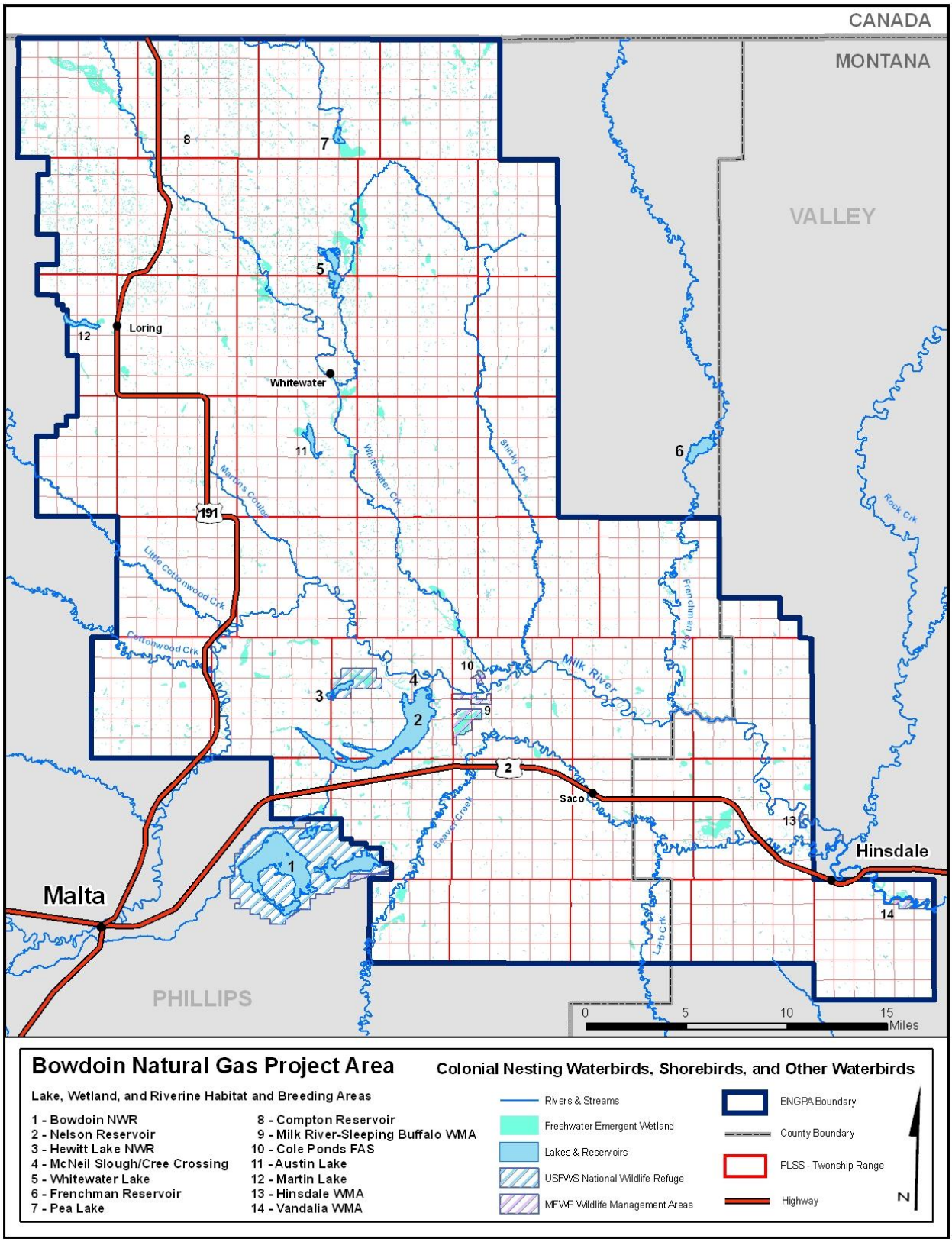
Colonial nesting waterbirds include species that form nesting colonies as small as a few pairs of individuals to large aggregations of several hundred pairs of birds. Several species display nesting colony associations including black-crowned night herons, eared grebes, Franklin's gulls, and white-faced ibises; black-crowned night herons and great blue herons; California gulls and ring-billed gulls; and Caspian terns and double-crested cormorants (Baird 1976, Trost 1989, Casey 2000). American white pelicans nesting colony islands often include other colonial nesting species such as double-crested cormorants, great blue herons, black-crowned night herons, common terns, and California and ring-billed gulls (MTNHP 2006*b*).

Colonial nesting waterbirds in the BNGPA tend to occupy sites with permanent bodies of water larger than 100 acres and sites with emergent vegetation along the shoreline (Feigley 1998). Several large lakes and reservoirs within and nearby the BNGPA provide nesting and foraging habitat for a variety of colonial nesting waterbirds. Nelson Reservoir, Whitewater Lake, and Hewitt Lake within the BNGPA may support nesting colonies of Caspian terns, common terns, California gulls, eared grebe, and ring-billed gulls (Feigley 1998, D. Prellwitz, BLM, personal communication; Table 3.12-3, Figure 3.12-8). Numerous ephemeral and semi-permanent potholes in the northern portion of BNGPA occasionally are used by colonial nesting waterbirds in wet years.

Important foraging and nesting habitat exists in adjacent Bowdoin NWR, located southwest of the BNGPA, and Frenchman Reservoir, located northeast of the BNGPA. Bowdoin NWR supports breeding colonies of at least 14 species (Table 3.12-3). Bowdoin NWR is one of the few locations in Montana where American white pelicans, Caspian terns, and Franklin's gulls breed, and it supports some of the largest colonies of black-crowned night herons and common terns in the state (Casey 2000, MTNHP 2006*b*). Frenchman Reservoir supports breeding colonies of double-crested cormorants, great blue herons, and various other colonial nesting species.

Colonial nesting waterbirds are susceptible to disturbance due to the large aggregation of nests built in a small area (Feigley 1998). Effects of fluctuating water levels, mammalian predators, and anthropogenic disturbance on nesting colonies are the primary reasons these species are a management concern.

Figure 3.12-8. Potential Breeding Areas and Habitat of Colonial Nesting Waterbirds, Shorebirds, and Other Waterbirds within and near the BNGPA



3.12.9 Shorebirds and Other Waterbirds (excluding colonial nesting species)

Shorebirds and other waterbirds include species belonging to the following avian orders: Gaviiformes (loons), Podicipediformes (grebes), Anseriformes (ducks, geese, and swans), Gruiformes (rails), and Charadriiformes (avocets, plovers, and sandpipers). Over 80 shorebird and waterbird species (excluding species discussed in previous sections) potentially could occur within the BNGPA, at least 50 of which breed within or nearby (USFWS 1999, MBDD 2006*a*, *b*; **Appendix B**). Seven shorebird and waterbird species are designated as Montana Animal Species of Concern (MTNHP 2006*a*; Table 3.13-3), and are discussed in detail in section **3.13**, **Special Status Wildlife, Fish, and Plants Species**.

Shorebirds and other waterbird species are locally abundant in suitable habitats throughout the BNGPA. Large lakes and reservoirs, prairie potholes and wetlands, and various rivers and streams in the BNGPA provide foraging and nesting habitat for many species of ducks, geese, swans, phalaropes, plovers, sandpipers, and cranes (Figure 3.12-8). Grasslands in the BNGPA provide nesting habitat for long-billed curlews, marbled godwits, mountain plovers, willets, and Wilson's phalaropes (MBDD 2006*a*). The waterfowl nesting season (April 15–July 15) generally begins earlier than the primary breeding season for most other migratory birds (May 1–August 1).

Many species of waterfowl nest within the BNGPA, including several species with noted population declines throughout North America. Northern pintail and canvasback populations have suffered marked declines in the last 30 years and have not recovered as expected despite recent favorable wetlands conditions and management modifications (Miller and Duncan 1999, CWSWC 2005). The northern portion of the BNGPA is located in the prairie pothole region which provides important nesting habitat for both species. Northern pintails nest in upland grasslands, and canvasbacks nest in emergent vegetation in wetlands or on BLM constructed nesting islands within the BNGPA (Prellwitz 1989, MTNHP 2006*b*).

Adjacent wetland habitat in Bowdoin NWR provides additional important foraging and breeding habitat for many of these species; at least 36 waterbird species nest within the refuge (USFWS 1999, MBDD 2006*a*).

3.12.10 Migratory Birds

The Migratory Bird Treaty Act, enacted in 1918, made it unlawful to pursue, hunt, kill, capture, possess, sell, purchase, or barter any migratory bird, including the feathers or other parts, nests, eggs, or migratory bird products. In addition, Executive Order 13186 (January 2001, President W. J. Clinton) set forth the responsibilities of federal agencies to implement further the provisions of the Act by integrating bird conservation principles and practices into agency activities and by ensuring that federal actions evaluate the effects of actions and agency plans on migratory birds.

The BNGPA supports a variety of habitats suitable for nesting migratory birds, including many grassland, sagebrush steppe, and riparian species. Over 140 migratory species (excluding species discussed in previous sections) potentially could occur within the BNGPA, at least 60 of which breed within or nearby (USFWS 1999, MBDD 2006*a*, *b*; Appendix B). Many are widespread prairie species, some are sagebrush obligates, and various species are endemic to the Northern Great Plains. Nineteen migratory bird species are designated as Montana Animal Species of Concern (MTNHP 2006*a*; Table 3.13-3), and are discussed in detail in section **3.13**, **Special Status Wildlife, Fish, and Plants Species**.

Lenard et al. (2006) conducted a breeding bird survey of grassland birds in northern Valley County adjacent to the BNGPA, and found at least 35 migratory bird species (excluding species in previous sections). Chestnut-collared longspurs, western meadowlarks, horned larks, Sprague's pipits, Baird's sparrows, and lark buntings accounted for 75 percent of all birds detected (Lenard et al. 2006). D. Prellwitz and M. Triska (BLM) summarized non-game bird transect data for various habitat types within the BNGPA for the period 1979 through 2006. Bird species were most abundant in riparian areas along the Milk River where two transects had 71 and 68 bird species present, respectively. The site with 71 species was dominated by mallard, European starling, and western meadowlark (34.47 percent). The site with 68 species was dominated by western meadowlark, European starling and common grackle (33.05 percent). Grasslands were next in terms of bird diversity. Fifty-five species were detected on one grassland site, dominated by chestnut-collared longspur, horned lark, and northern pintail (50.3 percent). Thirty-eight species were detected on another grassland site, led by McCown's longspur, horned lark, and chestnut-collared longspur (74.02 percent). Breaks/Badlands habitat had the lowest diversity, with two transects having 27 and 14 bird species present, respectively. The site with 27 species was dominated by rock wren, spotted towhee, and western meadowlark (55.6 percent). The site with 14 species was led by rock wren, western meadowlark, and chipping sparrow (67.2 percent).

3.12.11 Amphibians and Reptiles

The BNGPA provides a variety of habitats for amphibian and reptile species. Lakes, prairie potholes, rivers, streams, and other wetlands provide breeding and foraging habitat for amphibian, turtle, and snake species. Grasslands, rocky outcrops, and glacial till, especially with sandy and/or gravelly soils, support lizards and snakes including greater short-horned lizards, western hog-nosed snakes, bullsnakes, and western rattlesnakes. Sixteen amphibian and reptile species occur or potentially could occur within the BGNPA (Werner et al. 2004, D. Prellwitz, BLM, personal communication; Table 3.12-4). Five amphibian and reptile species are designated as Montana Animal Species of Concern (MTNHP 2006*a*; Table 3.13-3), and are discussed in detail in section **3.13**, **Special Status Wildlife, Fish, and Plants Species**.

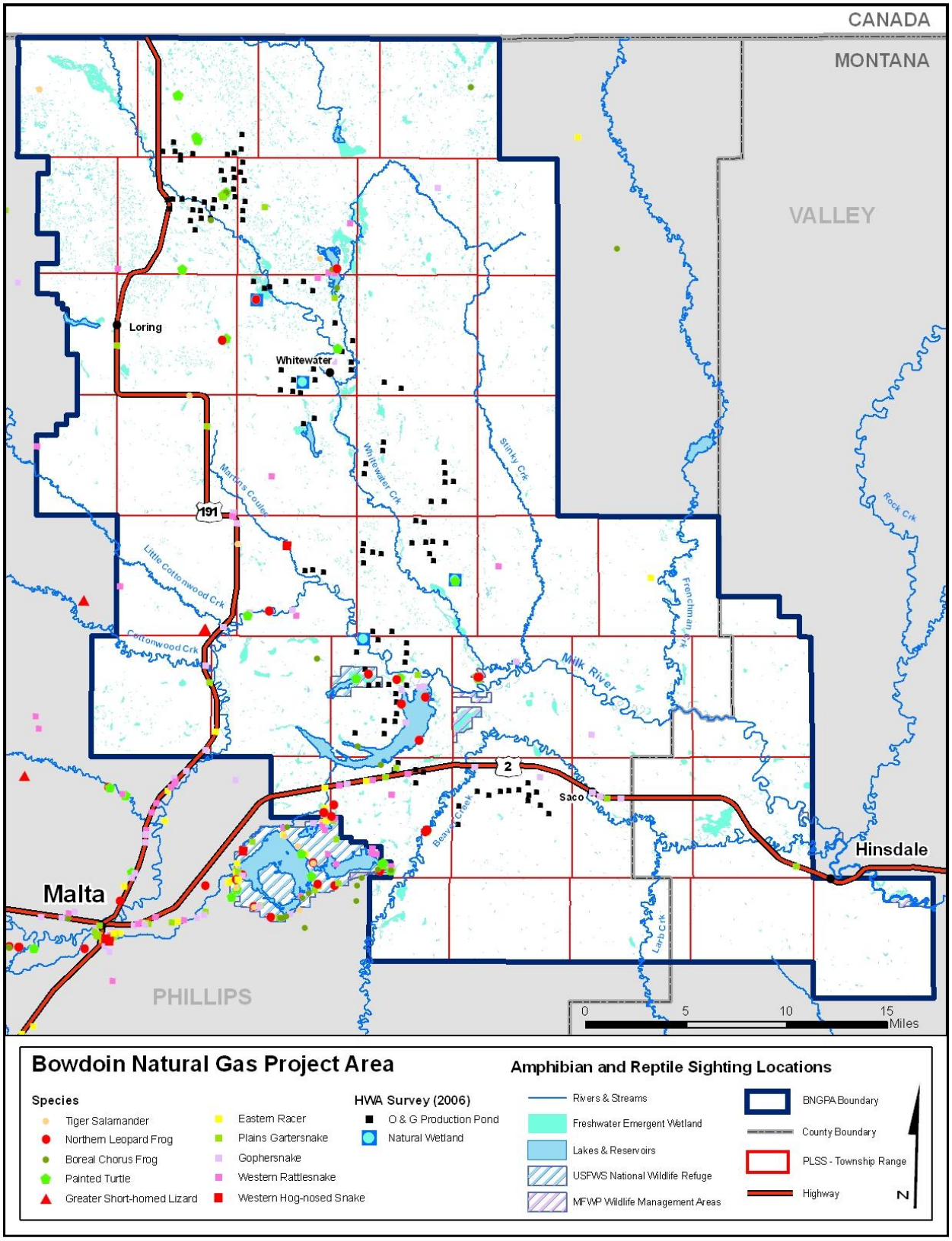
Various amphibian and reptile surveys have been conducted within and nearby the BNGPA over the last several decades (Hendricks and Reichel 1998; BLM, unpublished data; HWA, unpublished data). Surveys indicate that amphibian and reptile species are widely distributed throughout the BNGPA (Figure 3.12-9). Boreal chorus frogs, northern leopard frogs, and a painted turtle were detected during a survey conducted at several natural wetlands in the BNGPA in May 2006 (HWA, unpublished data). In addition, evidence of breeding northern leopard frogs was documented in a wetland in the northern portion of the BNGPA. No amphibians or reptiles were captured or observed in over 120 natural gas well production ponds sampled during the same survey, indicating that herpetafauna do not appear to be utilizing production ponds for breeding or foraging (HWA, unpublished data; Figure 3.12-9).

Table 3.12-4. Occurrence Potential of Amphibian and Reptile Species Within the BNGPA

Common Name[1]	Scientific Name	Occurrence Potential[2]
Tiger Salamander	*Ambystoma tigrinum*	P
Plains Spadefoot*	*Spea bombifroms*	pp
Great Plains Toad*	*Bufo cognatus*	pp
Boreal Chorus Frog	*Pseudacris maculata*	P
Northern Leopard Frog*	*Rana pipiens*	P
Painted Turtle	*Chrysemys picta*	P
Spiny Softshell*	*Apalone spinifera*	U
Greater Short-horned Lizard*	*Phrynosoma hernandesi*	P
Sagebrush Lizard*	*Sceloporus graciosus*	VU
Eastern Racer	*Coluber constrictor*	P
Western Hog-nosed Snake*	*Heterodon nasicus*	P
Milksnake	*Lampropeltis triangulum*	VU
Gophersnake	*Pituophis catenifer sayi*	P
Plains Gartersnake	*Thamnophis radix*	P
Common Gartersnake	*Thamnophis sirtalis*	pp
Western Rattlesnake	*Crotalus viridis*	P

[1] Special-status species indicated by asterisk.
[2] Occurrence potential include: present (P), potentially present (pp), unlikely (U), and very unlikely (VU).

Figure 3.12-9. Location of Amphibian and Reptile Sightings Within the BNGPA



3.12.12 Fish

A variety of ephemeral, intermittent, and perennial streams are present in the BNGPA and support many native and non-native species (Table 3.12-5). Five fish species are designated as Montana Animal Species of Concern (MTNHP 2006*a*; Table 3.13-3) and will be discussed in detail in section **3.13**, **Special Status Wildlife, Fish, and Plants Species**.

The Milk River and Nelson Reservoir are the most notable surface waters in the BNGPA and also are regionally important fisheries (MFWP 2006*a*). Frenchman Creek is a locally important fishery. Milk River tributaries within the BNGPA that do not sustain sport fisheries, but support a variety of non-game and game species, include Little Cottonwood Creek, Cottonwood Creek, Whitewater Creek, and Stinky Creek. Roads and pipelines associated with the Proposed Action traverse these streams and portions of wetland and riparian areas that provide aquatic habitat in the BNGPA.

The present-day Milk River results from a history of dams, channelization, flow modification, and expansion of land use, as well as natural development. The Milk River Basin has provided water for agricultural communities since the 1880s. East of Havre in the segment that flows through the BNGPA, the Milk River is paralleled by U.S. Highway 2 and marks the northern boundary of the Fort Belknap Indian Reservation. Below Vandalia Diversion Dam downstream of the BNGPA, the Milk River has well-developed riparian stands along its banks, deeper habitat, and cobble riffles. Perhaps the river's most important contribution to the area's fishery resource is its alliance with the Missouri River. In its lower-most 73 miles, the Milk River provides critical spawning and rearing habitat for migratory and resident fishes, including native species of the Missouri River such as blue sucker, channel catfish, freshwater drum, paddlefish, sauger, shorthead redhorse, and shovelnose sturgeon (MFWP 2006*b*).

Table 3.12-5. Occurrence Potential of Fish and Mussel Species Within the BNGPA and Adjacent Waters

Common Name[1]	Scientific Name	Game Status[2]	Native Status[3]	Occurrence Potential[4]					
				Milk River	Nelson Reservoir	Whitewater Creek	Cottonwood Creek	Frenchman Creek	Compton Reservoir
Bigmouth buffalo	*Ictiobus cyprinellus*	NG	N	x	x			x	
Black bullhead	*Ameiurus melas*	NG	N	x					
Black crappie	*Pomoxis nigromaculatus*	G	nn	x	x				
Blue sucker	*Catostomus discobolus*	NG	N	x					
Brassy minnow	*Hybognathus hankinsoni*	NG	N	x			x	x	
Brook stickleback	*Culaea inconstans*	NG	N	x		x	x		
Brook trout	*Salvelinus fontinalis*	G	nn	x					
Brown trout	*Salmo trutta*	G	nn	x					
Burbot	*Lota lota*	G	N	x	x			x	
Channel catfish	*Ictalurus punctatus*	G	N	x	x				
Cisco	*Coregonus artedii*	G	N	x					
Common carp	*Cyprinus carpio*	G	nn	x	x	x		x	
Creek chub	*Semotilus atromaculatus*	NG	N	x					
Emerald shiner	*Notropis aterinoides*	NG	N	x					
Fathead minnow	*Pimephales promelas*	NG	N	x		x	x	x	x
Flathead chub	*Hybopsis gracilis*	NG	N	x				x	
Freshwater drum	*Aplodinotus gruneins*	G	N	x					
Goldeye	*Hiodon alosoides*	NG	N	x	x			x	
Iowa darter	*Etheostoma exile*	NG	N	x		x			
Lake chub	*Couesius plumbeus*	NG	N	x			x	x	
Lake whitefish	*Coregonus clupeaformis*	G	nn	x	x				
Largemouth bass	*Micropterus salmoides*	G	nn	x					
Longnose dace	*Rhinichthys cataractae*	NG	N	x			x	x	
Longnose sucker	*Catostomus catostomus*	NG	N	x					
Mountain sucker	*Catostomus platyrhynchus*	NG	N	x					
Northern pike	*Esox lucius*	G	N	x	x	x		x	x
Northern redbelly dace	*Phoxinus eos*	NG	N	x		x	x		
Paddlefish*	*Polyodon spathula*	G	N	x					
Pallid Sturgeon*	*Scaphirhynchus albus*	G	N	x					
Pearl dace*	*Margariscus margarita*	NG	N	x					

Common Name[1]	Scientific Name	Game Status[2]	Native Status[3]	Occurrence Potential[4]					
				Milk River	Nelson Reservoir	Whitewater Creek	Cottonwood Creek	Frenchman Creek	Compton Reservoir
Plains minnow	*Hybognathus placitus*	NG	N	x				x	
Rainbow trout	*Oncorhynchus mykiss*	G	nn	x					
River carpsucker	*Carpiodes carpio*	NG	N	x				x	
Sauger*	*Stizostedion canadense*	G	N	x					
Sauger X walleye hybrid		G		x					
Shorthead redhorse	*Moxostoma macrolepidotum*	NG	N	x	x			x	
Shortnose gar*	*Lepisosteus platostomus*	NG	N	MR					
Shovelnose sturgeon	*Scaphirhynchus platorynchus*	G	N	x					
Smallmouth bass	*Micropterus dolomieu*	G	nn	x					
Smallmouth buffalo	*Ictiobus bubalus*	NG	N	x				x	
Spottail shiner	*Notropis hudsonius*	NG	N	x	x				
Stonecat	*Noturus flavus*	NG	N	x				x	
Walleye	*Stizostedion vitreum*	G	N	x	x			x	
Western silvery minnow	*Hybognathus argyritus*	NG	N	x					
Western silvery/plains minnow		NG	N	x				x	
White crappie	*Pomoxis annularis*	G	nn	x					
White sucker	*Catostomus commersoni*	NG	N	x	x	x	x	x	
Yellow perch	*Perca flavescens*	G	N	x	x	x			x
Black sandshell	*Ligumia recta*	NG	N	x					
Giant floater	*Anodonta grandis*	NG	N	x					

[1] Special-status species indicated by asterisk.
[2] Game status includes: game species (G), and non-Game species (NG).
[3] Native Status includes: native species (N), and non-native species (nn).
[4] Occurrence potential (L. Leslie, MFWP, personal communication, MFWP 2006*a*) includes: present or potentially present (x), and only known to be present downstream in the Missouri River (MR).

3.13 SPECIAL-STATUS WILDLIFE, FISH, AND PLANT SPECIES

Special-status species include: (1) threatened, endangered, candidates, or those petitioned for listing as threatened or endangered by the USFWS under the Endangered Species Act (ESA) of 1973, as amended; (2) those designated by the BLM State Director as sensitive (BLM 2004, 2005); and (3) Forest Service sensitive species, MFWP and MTNHP Animal Species of Concern.

3.13.1 Threatened, Endangered, Candidate or Proposed Species of Wildlife, Fish, and Plants

Five species listed by the USFWS as threatened, endangered, candidate, or proposed under the ESA may potentially be found or be affected by activities conducted within the BNGPA (USDI-FWS 2004; Table 3.13-1). There are no known FWS threatened, endangered, proposed, candidate, or experimental plant species documented on the BNGPA (Taylor 2006).

Table 3.13-1. Occurrence Potential of Threatened and Endangered Animal Species Within the BNGPA

Common Name[1]	Scientific Name	Occurrence Potential[2]	ESA Status[3]
Black-footed ferret	*Mustela nigripes*	U	E, XN
Piping Plover	*Charadrius melodus*	P	T
Interior Least Tern	*Sterna antillarum athalassos*	P	E
Whooping Crane	*Grus americana*	P	E
Pallid Sturgeon*	*Scaphirhynchus albus*	U	E

[1] Presence in Milk River downstream of BNGPA near confluence with Missouri River is indicated by asterisk.
[2] Occurrence potential includes: present (P); unlikely (U); and very unlikely but potentially affected (UPA).
[3] ESA status includes: Endangered (E); Threatened (T); and Experimental Non-essential (XN).

Mammal Species

Black-footed Ferret is considered the most endangered mammal species in the United States. The original distribution of black-footed ferrets in North America closely corresponded to that of prairie dogs (*Cynomys* spp.; Hall and Kelson 1959, Fagerstone 1987). Black-footed ferrets depend almost exclusively on prairie dogs for food, and they also use prairie dog burrows for shelter, parturition, and raising young (Hillman and Clark 1980, Fagerstone 1987). Black-footed ferrets historically ranged throughout most of the prairies of eastern Montana (MTNHP 2006*c*). Today, the only known population of black-footed ferrets in Montana is the result of the reintroduction of captive-bred ferrets. Reintroductions have occurred annually in Montana on federal and tribal lands since 1994. The reintroduced population is classified as nonessential experimental and, to date, is not self-sustaining (USDI-USFWS 1994, MTNHP 2006*c*).

The northern-most point of the designated reintroduction area is approximately 12 miles southwest of the BNGPA. The actual reintroduction sites are located over 50 miles away in the Fort Belknap Indian Reservation, Charles M. Russell NWR, and Beauchamp Creek (formerly the 40 Complex and Pea Ridge) in southern Phillips County (BLM 1992, USDI-USFWS 1994; D.

Prellwitz, BLM, personal communication). Black-footed ferrets currently exist in the Charles M. Russell NWR, where nine were sighted during a spotlight survey in April 2007 (R. Matchett). However, only one ferret was detected during surveys near Beauchamp Creek in September 2006 (D. Prellwitz, BLM, unpublished data). No ferrets were observed during surveys conducted by MFWP wildlife biologists in prairie-dog colonies adjacent to reintroduction areas during fall and early winter of 2006-2007 (R. Rauscher, MFWP unpublished data). Various formidable barriers exist between the black-footed ferret population and the BNGPA, including the Milk River, highways (e.g., U.S. 2, U.S.191), and the lack of an adequate prairie-dog colony complex.

Bird Species

Interior Least Terns are colonial nesting waterbirds found along the large river systems (i.e., Mississippi River and Missouri River) in the central United States. Montana defines the western edge of the interior least tern's range. Interior least terns are present in Montana from mid-May through mid-August. Breeding and nesting generally occurs along sparsely vegetated sand and gravel bars within large reservoirs and along riverine systems (Casey 2000, MTNHP 2006*b*). Interior least tern nesting sites are often associated with those of piping plovers (MPPRC 1994). Nesting has not been documented within the BNGPA although interior least terns have been observed on Nelson Reservoir, and recently on Whitewater Lake (D. Prellwitz, BLM, personal communication). The nearest nesting records for interior least terns have been documented along the Missouri River and islands in the Fort Peck Reservoir (Casey 2000, MTNHP 2006*b*). It is possible that interior least terns could expand their breeding range into the BNGPA due to the existence of suitable nesting habitat, proximity of known nesting sites, and breeding piping plovers. Interior least tern populations have declined throughout their range primarily as a result of the loss of its preferred nesting habitat. In addition to loss of habitat to development, interior least terns are particularly susceptible to fluctuations in water levels (Casey 2000, MTNHP 2006*b*). Consequently, they currently are listed as endangered by the USFWS.

Piping Plover is a shorebird species that breeds in south-central Canada and the Great Plains in the United States. Piping plovers are generally found in northern and northeastern Montana. Piping plovers are present in Montana from late April until late August and are limited to open shorelines of freshwater or alkaline bodies of water (Haig 1992, MTNHP 2006*b*). Piping plovers prefer wide, sparsely vegetated sand or pebble beaches, and gravel is the most suitable substrate for nesting (Haig 1992, MPPRC 1994). Piping plovers are known to breed in Bowdoin NWR and Nelson Reservoir within the BNGPA, and have been observed on Whitewater Lake (Prellwitz et al. 1989, MPPRC 1994, MBDD 2006*a*, D. Prellwitz, BLM, personal communication). Most piping plover observations within the BNGPA are either breeding birds or birds engaged in behavior suggesting breeding (Prellwitz et al. 1989, MBDD 2006*a*). Portions of Bowdoin NWR, most of Lake Bowdoin, and the western portion of the Dry Lake Unit have been designated as piping plover critical habitat (USFWS 2003). Although breeding occurs in the area, Nelson Reservoir was not designated as piping plover critical habitat as a result of an agreement reached among the U.S. Fish and Wildlife Service, the BOR, and local irrigation districts (USFWS 2003). Piping plover populations have declined throughout their range as a result of development and subsequent loss of their preferred beach-nesting habitat (Casey 2000). Consequently, they are currently listed as threatened by the U.S. Fish and Wildlife Service.

Whooping Cranes are large wading birds with only one migratory flock composed of approximately 236 individuals (WCEP 2008). Whooping cranes are not known to nest in Montana, but do migrate through the state en route between wintering areas in Aransas NWR in Texas and their breeding area in Wood Buffalo NP in Canada (Johnsgard 1986, Sibley 2000,

MTNHP 2006*b*). Observations of migrating or transient whooping cranes over the last 20 years have been limited to northeastern Montana and Red Rocks Lake NWR (MBDD 2006*d*). However, whooping cranes have not been observed at Red Rocks Lake NWR since 2002 (MTNHP 2006*b*). Whooping cranes have been recorded passing through Montana as early as late March during the spring migration and as late as the end of October during fall migration (MBDD 2006*d*). Whooping cranes prefer grain fields, shallow lakes and lagoons, and alkaline marshy areas during migration and in winter. Transient or migrating whooping cranes have been observed on various occasions within the BNGPA from late March to early April from 1990 to 2005 (D. Prellwitz, BLM, personal communication). All sightings were south or southwest of Whitewater, and included two reservoirs where cranes roosted over night (D. Prellwitz, BLM, personal communication). Whooping cranes have not been observed on Whitewater Lake, but sandhill cranes do stop there, and whooping crane use could be expected.

Fish Species

Pallid Sturgeon are considered to be year-round residents of the Milk River. They are known to occur downstream of the project area in the Milk River near its confluence with the Missouri River. A population is present in the Missouri River both upstream and downstream of Fort Peck Reservoir (MTNHP 2006*d*). Pallid sturgeon are native to major rivers in eastern Montana including the Missouri River below Fort Benton and the Yellowstone River below the Carterville Diversion Dam near Forsyth. Pallid sturgeon use the lower Yellowstone River primarily during spring and summer, but during fall and winter they use the Missouri River below the confluence with the Yellowstone. Some pallid sturgeon use the Fort Peck tailrace year-round, but others move downstream in spring (in one case more than 300 kilometers) (MTNHP 2006*d*). They inhabit large, turbid rivers over sand and gravel bottoms, usually in strong current, as well as impoundments on these rivers. They use all channel types but primarily straight reaches with islands. They primarily use areas with substrates containing sand (especially bottom sand dune formations) and fines (93 percent of observations). Preferred stream-bottom velocities range between 0.0 and 1.37 meters per second, with an average of 0.65 meter per second. Depths used were 0.6 to 14.5 meters and averaged 3.30 meters, and they appeared to move deeper during the day. Channel widths from 110 to 1,100 meters are used and average 324 meters (Bramlett 1996). Water temperatures used ranged from 2.8 to 20 ºC. Water turbidity ranged from 12 to 6,400 NTU (Turbidity Units) (MTNHP 2006*d*). The BNGPA does not contain any potential habitat for this species.

3.13.2 BLM Sensitive Species and Montana Animal and Plant Species of Concern

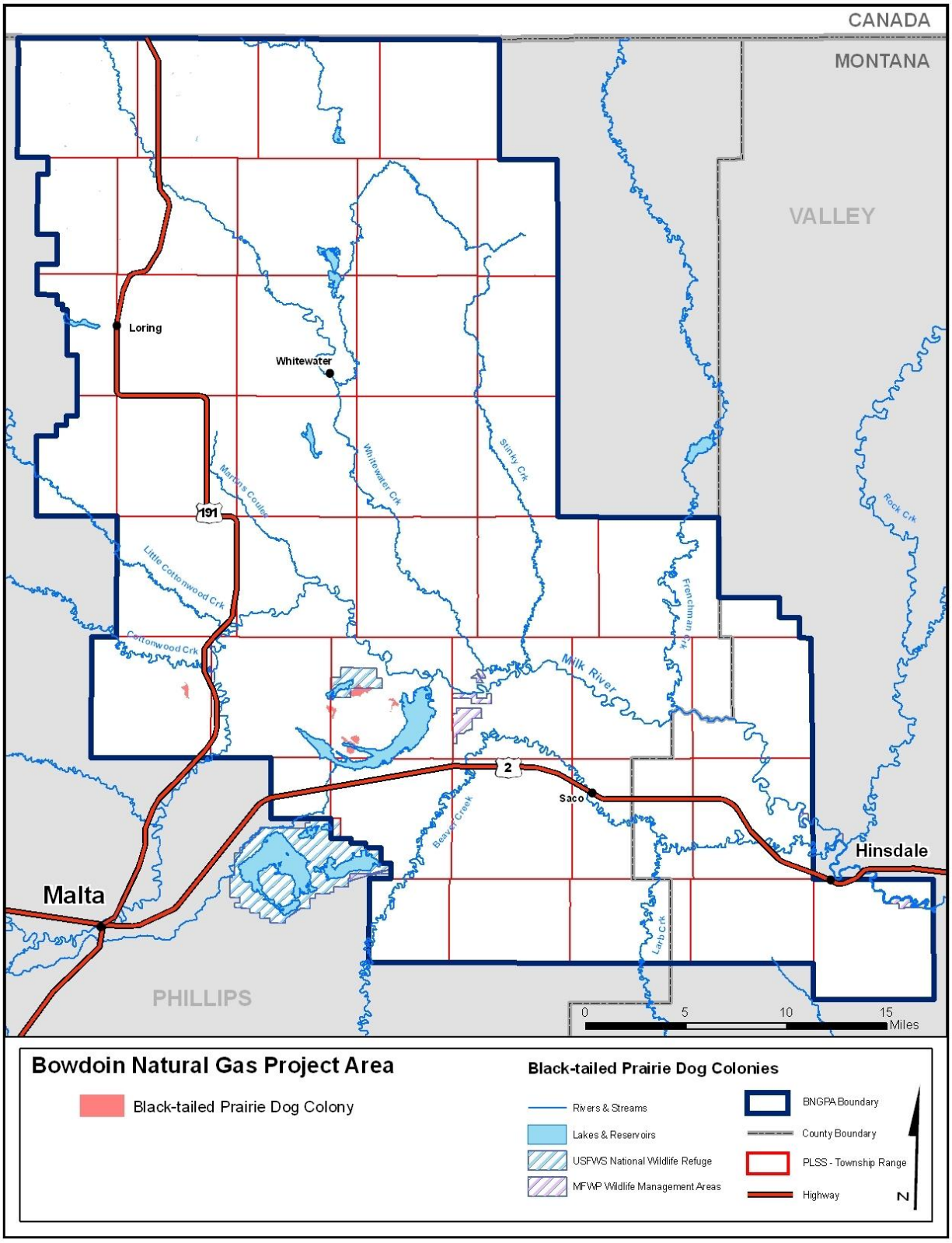
Sixty-one species designated by the BLM as sensitive or by the MTNHP and MFWP as Montana Animal Species of Concern are present, potentially present, or historically documented within the BNGPA, or potentially could be affected by the Proposed Action (BLM Manual 6840, MTNHP 2006*a*; Table 3.13-3).

Mammals

Black-tailed Prairie Dogs were once distributed widely throughout the grassland east of the Continental Divide (Burroughs 1961), and were found historically throughout the eastern two-thirds of Montana (MAFG 2005). However, black-tailed prairie dog populations have declined sharply from their historical levels both nationally and within Montana (Knowles 1999). There are many reasons for this decline, but the most common causes include eradication programs, the conversion of rangelands into agricultural land, recreational shooting, and sylvatic plague

(Knowles 1999). Partially as a result of these population declines, prairie dogs had been classified as 'non-game wildlife in need of management' (Montana HB492) and were managed under the Region Six Prairie Dog Abundance and Distribution Objectives Plan (MFWP 2006*c*). This management status changed with the "sunset" of prior legislation during the 2007 legislative session. Black-tailed prairie dogs are no longer considered a species in need of management; however, the prairie dog is recognized as a keystone species that greatly affects or alters the ecosystem in which it lives (Miller et al. 2000). Many other species have adapted to live within prairie-dog colonies, and some, such as the black-footed ferret, are prairie dog obligates (Knowles 1999). Three species associated with prairie-dog complexes—black-footed ferrets, burrowing owls, and mountain plovers—are species with special status and are classified as either endangered or sensitive (Table 3.13-3). There are seven black-tailed prairie-dog colonies in the BNGPA (BLM, unpublished data; Figure 3.13-1). However, these colonies do not support a Category 1 complex (i.e., 1.5 km rule) based on inter-colony distances and cumulative area of colonies (CBSG 2004, MFWP 2006*a*). Currently, no 1.5 km-rule complexes exist within MFWP Region 6 (MFWP 2006*a*).

Figure 3.13-1. Black-tailed Prairie Dog Colonies Within the BNGPA



Preble's Shrews have not been studied intensively, and relatively little is known about their distribution and ecology. Preble's shrews have been collected from Washington, Oregon, California, Idaho, Montana, Nevada, Colorado, and Utah, and appear to exist in disjunct populations, although this may be the result of an uneven sampling effort (Cornely et al. 1992). Preble's shrews have been collected from 14 localities within Montana, including one in Phillips County and one in Valley County (Hendricks and Roedel 2001). Preble's shrews are generally rare, where present, and have not been collected within the BNGPA (Hendricks and Roedel 2001). Nevertheless, distribution maps indicate that Preble's shrew have the potential to occur in suitable habitat within the BNGPA (MTNHP 2006*c*).

Swift Fox historically were common throughout the open plains of Canada, Wyoming, North and South Dakota, Colorado, Kansas, Nebraska and portions of Texas, Oklahoma, and New Mexico, and were once common throughout the eastern plains of Montana (Hoffmann et al. 1969, Scott-Brown et al. 1987). Swift fox experienced rapid population declines across their range from the 1900s to 1950s as the result of trapping; unintentional poisoning from coyote, wolf, rodent, and prairie dog eradication programs; and loss of prairie habitat (Samuel and Nelson 1982). Swift fox were declared extirpated from Montana in 1969 (Hoffmann et al. 1969). Sporadic sightings of swift fox persisted after 1969 in eastern Montana but were attributed to animals dispersing from reintroduction efforts in northwestern Montana and Canada (MTNHP 2006*c*). Swift fox reintroduction efforts in southern Alberta from 1983 to 1991 have been very successful, and populations in north-central Montana are established and expanding (Zimmerman 1998, Moehrenschlager and Moehrenschlager 2001). Swift fox are extremely common in the northern portion of the BNGPA and probably occur throughout the BNGPA. Den sites are known to be close to existing gas wells, and swift fox have been observed sleeping in the wind shadow of a gas well building (D. Prellwitz, BLM, personal communication). The population continues to increase as trapping surveys conducted in 2005-2006 found a far greater number of swift fox than were found in 2000–2001 (R. Rauscher, MFWP, unpublished data).

Townsend's Big-eared Bats have been documented in 20 counties in Montana (MTNHP 2006*c*). However, bat survey efforts have been limited, and detailed distribution maps for Montana cannot be drawn. Nevertheless, it is likely that Townsend's big-eared bats are distributed statewide (Hoffmann et al. 1969, Swenson and Shanks 1979, Foresman 2001, MTNHP 2006*c*). Townsend's big-eared bats commonly use caves and abandoned mines for maternity roosts and hibernacula (Foresman 2001). Five maternity colonies and several hibernucula are known to exist in Montana (MTNHP 2006*c*). Townsend's big-eared bats have not been documented within the BNGPA, and due to the lack of caves or abandoned mines that could serve as maternity roosts and hibernacula, their presence in the BNGPA is possible but unlikely.

Birds

Alder Flycatcher is primarily a boreal species that breeds in Canada and the northern United States and winters in northern South America (Lowther 1999). Scattered observations of alder flycatchers have been recorded throughout Montana during the breeding season, and only indirect evidence of breeding has been recorded to date (MTNHP 2006*b*). Alder flycatchers are present in Montana from May through July. Their preferred breeding habitat is wet thickets, and they commonly build nests in shrub thickets at the edge of wooded areas, along wetlands, or within damp fields and meadows (Peck and James 1987, Payne 1991, Lowther 1999). Alder flycatchers have been documented in Bowdoin NWR outside the BNGPA (MBDD 2006*a*). The Alder flycatcher is of management and conservation concern because Breeding Bird Survey

data indicates this species has declined across its range. Additionally, the rate of population decline for alder flycatchers is faster in Montana than it is nationally or across Canada (Sauer et al. 2005).

American White Pelicans breed in colonies located on bodies of water throughout central Canada and the north-central and northwestern portions of the United States. They winter in Mexico and coastal states in the southern United States (Evans and Knopf 1993, Sibley 2000). Five breeding colonies occur in Montana, and American white pelicans are seen throughout the state during summer (Casey 2000). American white pelicans are present within Montana from late March through the middle of October and breed from the beginning of May through the middle of August. American white pelicans in Montana as elsewhere can be found in a variety of aquatic habitats including rivers, lakes, and reservoirs (MTNHP 2006*b*). They are ground nesters and are particularly vulnerable to a variety of mammalian predators. Consequently, they tend to select breeding locations on islands or peninsulas that afford some protection from these hazards (Evans and Knopf 1993, Casey 2000, MTNHP 2006*b*). American white pelicans experienced population declines throughout the United States during the early 1970s. However, populations currently appear to have stabilized or be recovering (Evans and Knopf 1993). The Breeding Bird Survey indicates that American white pelican populations in the United States and Montana have been increasing slowly since 1980 (Sauer et al. 2005). The American white pelican remains a species of management and conservation concern because its colonies are very sensitive to disturbance during the breeding season (Evans and Knopf 1993, Casey 2000). Breeding adults may completely abandon a colony if disturbed during courtship and early incubation. Even after eggs have been laid and young have hatched, disturbed parents may leave nests, exposing eggs or young to the elements or predators. Other potential hazards include exposure to chemicals and pollutants, changes in water levels, and West Nile virus (Evans and Knopf 1993, D. Prellwitz, BLM, personal communication).

A breeding colony at the Bowdoin NWR just outside of the BNGPA has existed continuously for over 65 years, and American white pelicans regularly occur within the BNGPA (MTNHP 2006*b*). Breeding as well as non-breeding birds from Bowdoin NWR frequently feed on the Milk River, Whitewater Creek, and in stock ponds containing fish in the BNGPA (D. Prellwitz, BLM, personal communication). American white pelican mortalities due to West Nile virus are an emerging concern as they have been documented in Bowdoin NWR in recent years (D. Prellwitz, BLM, personal communication).

Bald Eagles are large North American fish eagles normally found near water. Bald eagles are found throughout North America, but primarily breed in Canada, Alaska, the Pacific Northwest, the Rocky Mountains, and the Great Lakes region. Bald eagle breeding is concentrated in the western third of Montana and along the Missouri River in the eastern prairies, but records of transient or migrant bald eagles have been documented throughout the state (MBEWG 1991, Casey 2000, MBDD 2006*c*). Most reproductive activity in Montana occurs from March through November, although bald eagles may be found in the state at all times of the year (MTNHP 2006*b*). Bald eagle nest site selection most likely depends upon availability of food in the early nesting season (Swenson et al. 1986). Nests typically are built of sticks and situated in the tops of coniferous or deciduous trees along streams, rivers, or lakes.

Breeding activity has not been documented within the BNGPA even though large perennial bodies of water are present. Nevertheless, observations of transient or migrant bald eagles are not unusual (MBDD 2006*c*, D. Prellwitz, BLM, personal communication). Documentation of bald eagles over-wintering within the BNGPA is extensive (MBDD 2006*c*). Roosting bald eagles are common during the winter in Bowdoin NWR, McNeil Slough/Nelson Reservoir area, and along

the Milk River within the BNGPA. Bald eagles consistently are observed during annual Christmas Bird Counts in McNeil Slough (every year from 2000-2006) and Bowdoin NWR (19 of 22 years from 1985-2006; Audubon 2006*a*, *b*). In addition, bald eagles are observed every year in the McNeil Slough/Nelson Reservoir area during the National Wildlife Federation's mid-winter bald eagle survey in early January. Gas well development in the winter frequently receives a timing stipulation and a condition of approval to protect roosting bald eagles within a half mile of the Milk River. These are slightly extended in the McNeil Slough/Nelson Reservoir area where bald eagle use is most likely to occur in early April (D. Prellwitz, BLM, personal communication). Consequently, bald eagle over-wintering within the BNGPA remains a concern.

Bald eagle populations in the Rocky Mountain States declined sharply during the late 1960s and 1970s, and consequently the species was listed as threatened. Bald eagle populations have recovered substantially since that time, and on August 9, 2007, the USFWS removed the bald eagle from the federal list of threatened and endangered species. Nevertheless, bald eagles are still afforded protection under the Migratory Bird Treaty Act and the Golden Eagle Protection Act. Montana had over 225 occupied nesting territories in 1999, and continues to be important for the recovery of bald eagles (Casey 2000). Breeding success must continue to be monitored within the state as part of the delisting process.

Baird's Sparrows breed in portions of Alberta, Saskatchewan, Manitoba, Montana, North Dakota, and South Dakota, and winter in portions of Arizona, New Mexico, Texas, and Mexico (Sibley 2000, Green et al. 2002). Baird's sparrows primarily are found in the eastern two-thirds of Montana, and are most common in the northeastern corner of the state (MTNHP 2006*b*). Baird's sparrows are present in Montana from the mid-May through the end of September; breeding occurs during the same time period. High-quality intermediate to tall native grassland prairie is the preferred habitat of Baird's sparrows (Green et al. 2002, Casey 2000, Lenard et al. 2006). However, recent research has shown that non-native vegetation may be acceptable provided the form and structure of the vegetation resemble that of native species (Sutter et al. 1995). Baird's sparrows are common in the BNGPA, and nest in the vicinity of many gas wells. Baird's sparrows nest in crested wheatgrass (*Agropyron cristatum)* adjacent to cropland and heavily grazed native prairie in the northern portion of the BNGPA (D. Prellwitz, BLM, personal communication). Bowdoin NWR has a large database on Baird's sparrow nesting since 1994; data from Bowdoin and other parts of northern Phillips County were instrumental in determining that listing the Baird's sparrow was not warranted (D. Prellwitz, BLM, personal communication). Baird's sparrows continue to be of management and conservation concern because of widespread population declines. They may be locally abundant in some areas, but are now considered rare throughout their range even though they were once considered one of the most abundant of the native prairie birds (Green et al. 2002, Sauer et al. 2005). Montana is considered particularly important for the conservation of this species because the state supports a large portion of the overall population of Baird's sparrows. The primary reason for the decline of this species is believed to be the removal or conversion of native prairies or non-native structural and functional equivalents to agricultural or other anthropogenic uses (Casey 2000, Green et al. 2002).

Black Terns are semi-colonial waterbirds that breed throughout Canada and the northern portions of the United States, and winter along coastal Mexico and Central and South America (Dunn and Agro 1995, Sibley 2000). The core of the black tern breeding range is within the Prairie Pothole region in the northern Great Plains of the United States and southern Canada (Casey 2000). Breeding has been documented in 12 counties in Montana, and unconfirmed sightings have been made in five additional counties located primarily in the northern part of the state (MTNHP 2006*b*). Black terns are present in Montana from mid-May through mid-

September. Breeding occurs from the first of June through the end of August. Black terns nest in shallow freshwater wetlands with emergent vegetation including marshes, prairie potholes, sloughs, and small ponds (Dunn and Agro 1995, MTNHP 2006*b*). Black terns in Montana select wetlands or wetland complexes with 30 to 50 percent emergent vegetation (MTNHP 2006*b*). They nest in Bowdoin NWR just outside of the BNGPA, and immature terns have been observed feeding on Nelson Reservoir (D. Prellwitz, BLM, personal communication). Black terns are of management and conservation concern because of widespread population declines during the 1960s (Casey 2000). These population declines most likely were caused by the draining of wetlands throughout the Prairie Pothole region and the conversion of these habitats to agricultural uses (Dunn and Agro 1995, Casey 2000). However, Breeding Bird Survey data indicate that black tern populations have stabilized and appear to be slightly increasing in some areas of their range in recent years (Sauer et al. 2005). Some breeding areas within the BNGPA have been dry for several years recently, and drought is a major concern (D. Prellwitz, BLM, personal communication).

Black-and-white Warblers are Neotropical migrants that breed throughout most of the eastern United States and across much of southern Canada They winter in Florida, throughout Mexico, Central and South America, and the Caribbean (Kricher 1995). Transient black-and-white warblers have been observed across Montana, and indirect evidence of breeding has been reported on a few occasions (MTNHP 2006*b*). Black-and-white warblers are present in Montana from the first of May through the middle of October, but breeding and brood-rearing dates are poorly documented. Information regarding the habitat requirements of black-and-white warblers in Montana is limited, but existing data indicate a preference for riparian habitats and woody draws (MTNHP 2006*b*). Generally, black-and-white warblers prefer mature deciduous or mixed forests (Kricher 1995). Black-and-white warblers are relatively uncommon, but they potentially could be found within the riparian and wooded portions of the BNGPA. Black-and-white warbler populations appear to be stable throughout most of their range compared to many other Neotropical migrant species (Kricher 1995, Sauer et al. 2005). However, because of their preference for mature forests, they are sensitive to logging or other activities which remove mid- and late-successional forests.

Black-crowned Night-heron is a widespread, colonial nesting species that breeds and/or is a year-round resident throughout much of the United States, and winters and/or is a year-round resident throughout Mexico and Central America (Davis 1993, Sibley 2000). This species has been observed throughout much of Montana, but most observations are restricted to the eastern part of the state, particularly the northeast corner (MTNHP 2006*b*). Records of breeding black-crowned night-herons are sparse, but occurrences are scattered throughout the state (MTNHP 2006*b*). Black-crowned night-herons are present in Montana from the first part of April through the end of September. Breeding and brood-rearing occurs from the first part of May through the end of August. Black-crowned night-herons breed in marshes, swamps, other wetland habitats (Davis 1993, Casey 2000, MTNHP 2006*b*). Nest sites often are located on islands, within swamps and wetland areas, or in areas which are otherwise not easily assessable; this nesting preference generally is believed to be a predator avoidance strategy (Davis 1993, Casey 2000).

The largest breeding colony of black-crowned night-herons in Montana is located in the Bowdoin NWR just outside of the BNGPA (MTNHP 2006*b*). Black-crowned night-herons should be considered present in the BNGPA with feeding possible wherever minnows are present. Other rookeries occur farther south and southwest of the BNGPA on larger BLM reservoirs (D. Prellwitz, BLM, personal communication). Declines in populations of black-crowned night herons were noted during the 1960s, presumably because of DDT use (Davis 1993). Currently their populations have stabilized and may be increasing slightly in some areas (Sauer et al. 2005).

However, the black-crowned night-heron remains a species of management and conservation concern because it is a colonial nesting species whose colonies are susceptible to disturbance (Davis 1993, Casey 2000).

Bobolinks breed throughout the northern United States and southern Canada and winter in the grasslands of Brazil, Paraguay, and Argentina (Martin and Gavin 1995). Bobolinks breed widely throughout Montana (MTNHP 2006*b*). They are present in Montana from the middle of May through the middle of September and reproduce during the same period. Bobolinks are grassland nesting birds that traditionally nested in the tall-grass or mixed-grass prairies in the United States and Canada (Bent 1958). Bobolinks prefer areas with high grass-to-forb ratios, but avoid habitats with high legume (i.e., alfalfa) components (Bollinger 1995). Bobolinks occur during the breeding season in irrigated hay land adjacent to Bowdoin NWR, some of which is within the BNGPA. They have also been observed at Pea Lake north of Whitewater Lake, and at other locations in the Milk River Valley (MBDD 2006*b*, D. Prellwitz, BLM, personal communication). Bobolink populations continue to decline throughout most of their range. However, Bobolink populations appear to have stabilized or be on the increase throughout North Dakota, South Dakota, and the eastern third of Montana (Sauer et al. 2005). These declines are primarily the result of grassland being converted to other uses (Martin and Gavin 1995). Bobolinks are sensitive to any activity that reduces the amount of grassland available, and they continue to be of management and conservation concern.

Brewer's Sparrows are sagebrush obligates and breed throughout the intermountain west of the United States. They winter in the southern portions of California, Arizona, New Mexico, western Texas and down through the central part of Mexico (Rotenberry et al. 1999, Sibley 2000). Brewer's sparrows breed throughout Montana (MTNHP 2006*b*). Brewer's sparrows are present in Montana from the middle of May through the end of September and reproduce during the same period. They will breed in a variety of shrubland habitats but prefer areas dominated by big sagebrush (*Artemisia tridentata*; Rotenberry et al. 1999). Brewer's sparrows prefer to nest in shrubs that are taller and denser than average (Petersen and Best 1985). Breeding has been recorded in and around the BNGPA (MBDD 2006*a*). Brewer's sparrows probably breed within the BNGPA, and the absence of direct evidence of breeding is due more to a lack of observers and survey efforts than to a lack of birds (D. Prellwitz, BLM, personal communication). Optimal Brewer's sparrow habitat in the BNGPA exists in the big sagebrush communities in the Larb Hills (locally known as the Saco Hills) in the southern portion of the BNGPA. Brewer's sparrows are of management and conservation concern because of widespread population declines throughout their range (Rotenberry et al. 1999, Sauer et al. 2005). These population declines are believed to be the result of habitat degradation/conversion (Rotenberry et al. 1999). This species also appears to be particularly sensitive to habitat fragmentation, as it is affected more by changes in landscape-level attributes than changes at a local level (Knick and Rotenberry 1995).

Burrowing Owls are found throughout the plains and prairies of the western United States (Haug et al. 1993). They have been reported throughout Montana, but most observations and breeding activity are limited to the eastern two-thirds of the state (MTNHP 2006*b*). Burrowing owls are present in Montana from the beginning of May through mid-September and breed and raise young during the same time period. Burrowing owls have the capacity to excavate their own burrows but seldom do relying instead on mammals such as prairie dogs, ground squirrels, and badgers (Thomsen 1971, Casey 2000). The burrowing owl's close association with burrowing mammals suggests dependence on them (Haug et al. 1993). Knowles (1999) suggested that burrowing owls are near prairie-dog obligates because their distribution is so closely tied to that of prairie dogs in Montana. Nevertheless, burrowing owls probably use

prairie-dog colonies because they are available. Burrowing owls also use isolated ground-squirrel and badger burrows in hillsides and roadside borrow ditches long distances from prairie-dog colonies. At least 25 nest burrows with breeding burrowing owls have been documented within or immediately adjacent to the BNGPA (BLM, unpublished data; Figure 3.12-7). Burrowing owls are known to nest on well pads adjacent to gas well buildings. Burrowing owls nest in a prairie-dog colony in Hewitt Lake NWR and near Nelson Reservoir within the BNGPA where several gas wells are present (E. Atkinson, MFWP, unpublished data). Burrowing owls are listed as threatened, endangered, or of special concern across most of their range, including Montana, as a consequence of long-term population declines (Haug et al. 1993). Because of the strong association between burrowing owls and prairie dogs, declines in the burrowing owl population have been linked to many of the same factors associated with declining prairie dog populations (i.e., rodent-eradication programs and habitat loss). Furthermore, long-term conservation of burrowing owls will likely be closely linked to the conservation and preservation of prairie-dog complexes, Richardson's ground squirrels, and other burrowing mammals (Casey 2000).

Caspian Tern is an uncommon, colonial nesting species that breeds in the western and northern United States and Canada (Sibley 2000). It can be found year-round along the coasts of the southern United States, Mexico, and Central America where populations that breed in the interior of North America join them in the winter (Sibley 2000). Caspian terns have been documented throughout Montana, but most observations are of transient individuals. Breeding colonies are known to occur at less than a dozen locations in Montana (MTNHP 2006*b*). Caspian terns are present in Montana from the middle of April through the end of September. Reproduction occurs from mid-May through mid-August. Caspian terns normally nest colonially, but may nest in very low numbers, even singly in Montana (MTNHP 2006*b*). Sandy or gravelly beaches on islands within large lakes or reservoirs are their preferred nesting habitat (Casey 2000, MTNHP 2006*b*). Caspian terns occasionally nest on the same islands as double-crested cormorants and pelicans (MTNHP 2006*b*, D. Prellwitz, BLM, personal communication). Caspian terns are known to breed on the pelican islands in Lake Bowdoin just outside the BNGPA. In addition, Caspian terns are observed every summer on Nelson Reservoir within the BNGPA where a breeding colony is suspected (D. Prellwitz, BLM, personal communication). Caspian tern is a species of management and conservation concern because little is known about its nesting status, distribution, and habitat requirements; like other colonial nesting species, its colonies are susceptible to disturbance (Casey 2000).

Chestnut-collared Longspurs are native prairie specialists and breed in the northern prairies of the northern Great Plains of the United States and southern Canada. They winter in the southwest and south-central portions of the United States and down through the central portions of Mexico (Hill and Gould 1997). Chestnut-collared longspurs are common and breed throughout the eastern two-thirds of Montana. They are present in Montana from the beginning of May through mid-October, concurrent with breeding and brood-rearing. Chestnut-collared longspurs have been described as native prairie specialists (Anstey et al. 1995). Historically they bred in the mid- and short-grass prairies and preferred areas that had been grazed by bison (*Bos bison*) and disturbed by fire (Hill and Gould 1997). Anstey et al. (1995) reported that densities of breeding birds were greater in native grasslands than pastures. Within native grasslands, bird densities were greater in grazed areas than ungrazed areas (Maher 1973). Chestnut-collared longspur nests are quite common when well pads and gas pipeline routes are nest-dragged prior to construction during the migratory-bird nesting season. Their nest success rate is very high in Phillips County. Bowdoin NWR has had a large database of longspur nests since 1994, and many birds have been banded in the refuge. The species is the most common bird found on BLM non-game bird linear transects conducted since 1979 (D. Prellwitz, BLM,

personal communication). Chestnut-collard longspur populations have declined substantially from historic levels throughout their range (Hill and Gould 1997). Short-term population trends are less clear, but indicate that populations may have stabilized in many portions of their range, including Montana (Sauer et al. 2005). However, this species remains of management and conservation concern because of its reliance upon native prairie habitats. Montana and adjacent states, which retain much of the remaining native prairies, are particularly important for the conservation of native prairie species (Casey 2000).

Common Loons are solitary and reclusive waterbirds whose preferred habitats are secluded lakes or estuaries across much of its range. Common loons have been documented throughout most of Montana. However, most observations are of transient/migrant birds. Breeding occurs mostly in the western third of the state with few exceptions (MTNHP 2006*b*). Common loons are present in Montana from mid-April through mid-November; reproduction occurs during the same period. Common loons in Montana nest on relatively large lakes (>13 acres) below 5,000 feet in elevation, with suitable nesting (i.e., small islands, herbaceous shorelines) and nursery (i.e., sheltered, shallow coves) areas (MTNHP 2006*b*). Common loons occur on large bodies of water within the BNGPA, most commonly on Nelson Reservoir (D. Prellwitz, BLM, personal communication). Up to a hundred loons have been observed during the spring migration season in April, and lesser numbers during the fall migration within the BNGPA. A small number of loons remain on Nelson Reservoir through the summer with frequent territorial calling. A brood was observed in the early 1990s, but water-level fluctuations and recreational use make nesting difficult and improbable in most years (D. Prellwitz, BLM, personal communication).

Common Tern is a colonial nesting species that breeds in the northern United States and Canada (Sibley 2000). Nesting common terns may form colonies of tens, hundreds, and sometimes thousands of pairs. Common terns have been documented throughout Montana, but most breeding occurs in the northern plains (MTNHP 2006*b*). Common terns are present in Montana from mid-April through the end of September. Breeding and brood-rearing occur from mid-May through the end of August. Common tern colonies in Montana normally are formed of less than 50 pairs, but numbers may range from less than 10 to several hundred. Sparsely vegetated sandy, pebbly, or stony beaches surrounded by matted or scattered vegetation on islands within large lakes or reservoirs comprise their preferred nesting habitat. Common terns occasionally nest on the same islands as double-crested cormorants and pelicans (MTNHP 2006*b*, D. Prellwitz, BLM, personal communication). Common terns nest on Nelson Reservoir, Whitewater Lake, and possibly on other large waterbodies in wet years. Bowdoin NWR, just outside of the BNGPA, is one of the areas in Montana with the highest recorded number of nesting common terns. Common terns also nest on Nice Pond southwest of the BNGPA. Stock ponds and pools in Whitewater Creek where minnows are present attract common terns for feeding. The common tern is of management and conservation concern because like other colonial nesting species, its colonies are susceptible to fluctuating water levels and human disturbance (Casey 2000).

Ferruginous Hawks are primarily found in mixed-grass prairie and sagebrush steppe habitats. The breeding population in Montana is migratory, and most birds winter in Texas and northern Mexico (MTNHP 2006*b*). Ferruginous hawks are present in Montana from mid-March through the end of September with breeding occurring during the same period. Breeding occurs in and around the BNGPA. Suitable nesting habitat for ferruginous hawks exists in the breaks of the Cottonwood Creek, Little Cottonwood Creek, and Frenchman Creek drainages. At least six ferruginous hawk nest sites are located within or immediately adjacent to the BNGPA (Figure 3.12-7). Ferruginous hawk populations appear to be increasing in Montana; however, they are of special concern due to their sensitivity to habitat change and disturbance (Casey 2000).

Forster's Tern is a colonial nesting species that breeds in the intermountain west across the northern United States and southern Canada, the Great Plains, and south into Texas (Sibley 2000). Forster's terns normally migrate in small groups through the interior of North America, and arrive earlier and depart later than common terns. Scattered reports of Forster's Tern have been recorded throughout Montana. Some breeding does occur within the state though most sightings are of transient/migrant birds (MTNHP 2006*b*). Forster's terns are present in Montana from the beginning of May through the end of September. Reproductive activity occurs from mid-May through mid-August. Forster's terns in Montana generally prefer large marsh complexes with sizeable reed beds occasionally along the borders of lakes and reservoirs. Direct evidence of breeding Forster's terns has been reported west of the BNGPA (Casey 2000, MBDD 2006*a*). It is possible that an occasional Forster's tern nesting in Bowdoin NWR outside the BNGPA, or on Nelson Reservoir and Whitewater Lake within the BNGPA, has gone unnoticed due to the similarity between them and common terns (D. Prellwitz, BLM, personal communication). Forster's tern is of management and conservation concern because little is known about its nesting status, distribution, and habitat requirements, and because like other colonial nesting species, its colonies are susceptible to fluctuating water levels and human disturbance (Casey 2000).

Franklin's Gull is a colonial nesting species that breeds in the intermountain west and the Great Plains of the northern United States and Canada. Franklin's gulls primarily migrate through the Great Plains to wintering grounds along the Pacific coast of South America (Casey 2000). Observations of Franklin's gull are widely distributed across Montana, and although most of these sightings have been of transient/migrant birds, isolated observations of breeding activity have been documented (MTNHP 2006*b*). Franklin's gulls are present in Montana from mid-April through mid-October. Reproductive activity occurs from mid-May through mid-August. Franklin's gulls build floating nests in marshy areas in colonies of a few pairs to several hundred pairs. The size of the breeding colony at Bowdoin NWR just outside of the BNGPA can vary greatly depending upon water conditions. Large numbers of migrating immature birds also can be present during migration in August. Franklin's gulls use Nelson Reservoir for feeding, but nesting is not known in that location (D. Prellwitz, BLM, personal communication). Franklin's gull is a species of management and conservation concern because like other colonial nesting species, its colonies are susceptible to fluctuating water levels and disturbance, and significant population declines have been noted over the past 30 years (Casey 2000).

Grasshopper Sparrow is a grassland species that breeds throughout the United States and southern Canada. Grasshopper sparrows primarily breed in the Great Plains in the eastern two-thirds of the state (MTNHP 2006*b*). Grasshopper sparrows are present in Montana from the beginning of May through mid-September; reproductive activity occurs during the same period. Grasshopper sparrows prefer grasslands of intermediate height which include patches of sparse woody vegetation, somewhat deep litter, and bunchgrasses interspersed with bare ground. Grasshopper sparrows also use CRP plantings and croplands, but are sensitive to grazing and are found at much lower densities than in native habitats (Casey 2000). Bowdoin NWR has a large database of nest data for the grasshopper sparrow since 1994. Grasshopper sparrows can be locally abundant in short-grass habitat throughout much of the BNGPA (D. Prellwitz, BLM, personal communication). Grasshopper sparrow populations have experienced declines across their range; however, populations in the northern Great Plains and Montana appear to be doing well (Casey 2000).

Gray-crowned Rosy-finches breed from Alaska to the northern Rockies and winter in large flocks in the Great Plains and intermountain west (Sibley 2000). Gray-crowned rosy-finches have been observed throughout most of the state of Montana. Though wintering populations

have been recorded throughout most of Montana, breeding activity is restricted to the western third of the state (MTNHP 2006*b*). Gray-crowned rosy-finches are present year-round in Montana, but breeding and brood-rearing activity occurs from the beginning of June through the middle of August. Gray-crowned rosy-finches prefer to nest in crevices in cliffs and talus slopes above timberline and winter in open areas including fields, cultivated lands, brushy areas, and occasionally, short-grass prairie (MTNHP 2006*b*). No breeding has been reported within or near the BNGPA, but winter sightings in the Cottonwood Creek breaks have been documented. Gray-crowned rosy-finches appear to utilize available tree and shrub habitat, and occasional use of gravel roadsides was also observed in the BNGPA (D. Prellwitz, BLM, personal communication). Loss of traditional winter roost sites in abandoned mine shafts appears to be a risk factor for this species (MTNHP 2006*b*).

Greater sage-grouse are sagebrush obligates found entirely in the western United States, primarily in the intermountain west (Sibley 2000). Greater sage-grouse breed throughout most of the southeastern two-thirds of Montana, but are largely absent in the northwestern portions of the state (MTNHP 2006*b*). They are present year-round in Montana, but reproductive activity occurs from mid-April through the end of July. Greater sage-grouse depend upon extensive areas of sagebrush for food and cover throughout the year. Typically, strutting grounds or leks are located in open patches within sagebrush habitat, and the surrounding area is considered potential nesting habitat. Nesting habitat tends to have higher sagebrush density, taller live and residual grasses, more live and residual grass cover, and less bare ground than areas favored for leks (Connelly et al. 2004).

The entire BNGPA is classified as occupied Greater sage-grouse habitat of varying conditions (Table 3.13-2, Figure 3.13-2). The majority of the BNGPA is comprised of vast grassland prairies and is considered sub-optimal habitat because it is fragmented and sagebrush-limited. Silver sage is the predominant sage species intermixed in the prairies in the northern portion of the BNGPA. The most variable and fragmented habitat is concentrated around the Milk River Valley and the U.S. Highway 2 corridor where the majority of human habitations are concentrated. Habitat with sagebrush-limited cover exists around several leks near the Milk River and Whitewater Creek in the western and central portions of the BNGPA, respectively, and in the northeastern part of the BNGPA around the Thoeny Hills area. Excellent habitat with adequate sagebrush and understory cover is located in the Saco Hills in the southern portion of the BNGPA. Some winter habitat in sagebrush exists along the Milk River on the western side of the BNGPA, although it may not be occupied by sage-grouse during mild winters. Only small numbers of birds have been observed in the area in recent years during winter (D. Prellwitz, BLM, unpublished data).

Table 3.13-2. Condition of Greater Sage-grouse Habitat Within the BNGPA

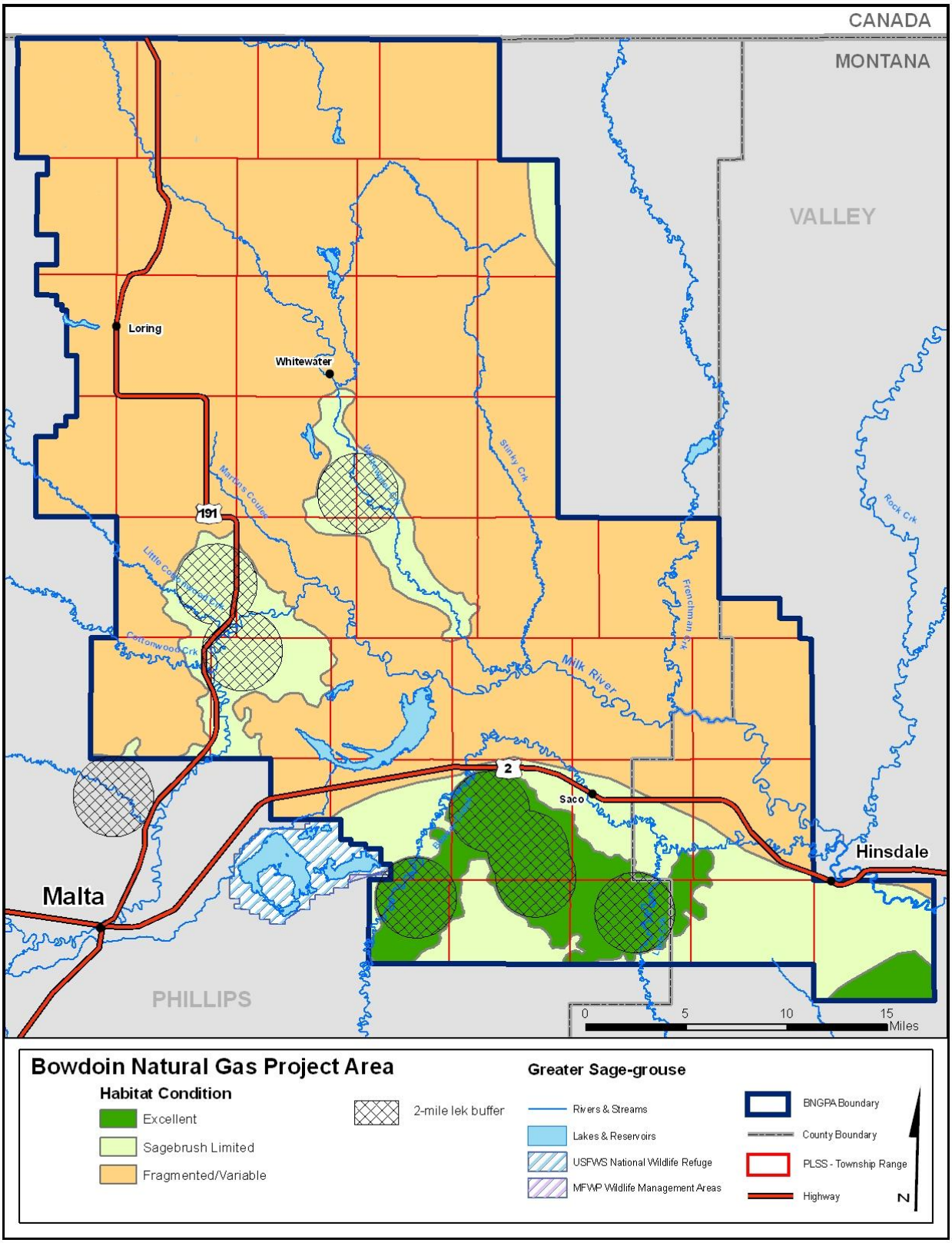
Habitat Condition	Acres of Habitat	Percentage of BNGPA
Excellent	59,673	7.3
Sagebrush limited	138,539	17.1
Sagebrush & Understory limited	614,177	75.6
Fragmented/Variable	59,673	7.3

Greater Sage-grouse leks are located in and around the BNGPA (Figure 3.13-2). Eight active leks are located within the BNGPA. One lek south of Whitewater is located near several gas buildings, access roads, and a power line. The number of males attending leks over the last eight years has remained relatively stable according to MFWP lek count data (M. Sullivan,

MWFP, unpublished data). Greater sage-grouse reproduction occurs within the BNGPA, and broods have been observed in recent years.

Sage-grouse exhibit site fidelity to leks, winter and summer areas, and nesting areas (Schroeder et al. 1999). Sage-grouse may be susceptible to sagebrush community disturbance and removal, as well as to construction of fences, above-ground power lines, and other above-ground structures. They tend to avoid areas that may provide perching or roosting opportunities for raptors (i.e., fence posts, power lines). Human activities during the breeding season may disrupt normal use of leks, and subsequently affect local breeding success. Therefore, steps should be taken to ensure that impacts to sage-grouse habitats, especially leks and nesting areas, are minimized. Populations across the west have declined from historic levels due to a wide range of factors including drought, habitat loss, and habitat degradation (Connelly and Braun 1997, Braun 1998, Connelly et al. 2000). Recently, the USFWS conducted a status review of greater sage-grouse throughout its range in response to petitions requesting the listing of this species under the ESA. Recently, the USFWS conducted a status review of Greater sage-grouse throughout its range in response to petitions requesting the listing of this species under the ESA. On January 7, 2005, the USFWS determined that the Greater sage-grouse did not warrant protection under the ESA. Nevertheless, on December 4, 2007, U.S. District Court Judge B. Lynn Winmill reversed the USFWS decision and remanded the case to the agency for further consideration. A decision from the USFWS is expected in late 2008 or early 2009.

Figure 3.13-2. Habitat Condition Classes and Two-mile Lek Buffers of Greater Sage-grouse Within the BNGPA



Harlequin Ducks breed in the northern Rocky Mountains in the contiguous United States and winter along the Pacific Coast (Sibley 2000). Observations and breeding records of Harlequin ducks within Montana are limited primarily to the northwestern portions of the state (MTNHP 2006*b*). Harlequin ducks are present in Montana from the middle of April through the end of September. Breeding and brood-rearing occur from the beginning of May through the end of August. Harlequin ducks prefer clear, fast-moving steams and extremely turbulent water. They nest on the ground, on rocks, in piles of woody debris, and in tree and cliff cavities (MTNHP 2006*b*). Observations of transient/migrant individuals have been reported near the BNGPA. Records exist for two separate sightings at Bowdoin NWR just outside of the BNGPA. Harlequin ducks, if present within the BNGPA, most likely would be observed on Nelson Reservoir (D. Prellwitz, BLM, personal communication). Harlequin ducks are of management and conservation concern because of their dependence on clean headwater streams for nesting and brood-rearing (Casey 2000).

Lark Bunting is a conspicuous and gregarious species of the short-grass and mixed-grass prairies. Lark buntings breed in the Great Plains and central United States and winter in the southern United States and Mexico (Sibley 2000). They have been recorded throughout Montana, but breeding activity is limited to the eastern two-thirds of the state (MTNHP 2006*b*). Lark buntings are present in Montana from mid-May through mid-September. Breeding and brood-rearing activity occur during the same period. Lark buntings build nests on the ground or in shrubs in areas with high grass cover, very little bare ground, and a moderate shrub or tall forb cover (Casey 2000). They breed within the BNGPA and are the most abundant of all birds listed on the South Malta Breeding Bird Survey conducted just south of the BNGPA. Lark buntings in the BNGPA usually build nests in short shrubs or near shrubs such as sagebrush or greasewood. Two nests were found near a gas well pad southwest of Whitewater in 2005. Huge flocks of fledgling buntings are observed foraging on sunflower seeds along county roads in August and early September throughout the BNGPA (D. Prellwitz, BLM, personal communication). Lark bunting populations have experienced declines across their range primarily due to loss of habitat and grasshopper-control practices. Habitat remaining in Montana is important for lark bunting conservation because a large percentage of the existing population breeds in the state (Casey 2000).

Le Conte's Sparrows breed throughout the grasslands of central Canada, eastern North Dakota, northern Minnesota, and the Upper Peninsula of Michigan. They winter from southern Missouri down through the Gulf Coast states (Lowther 1996, Sibley 2000). The primary breeding range of the Le Conte's sparrow is peripheral to Montana (Lowther 1996), but several isolated breeding populations do exist in northwestern (Flathead County) and northeastern (Sheridan County) Montana (Casey 2000, MTNHP 2006*b*). Le Conte's sparrows are present in Montana from mid-May through the end of September. Reproductive activity occurs throughout the same time period. Le Conte's sparrows prefer wet grasslands and marshes with a strong sedge component (Lowther 1996). They appear only to be occasional visitors to the BNGPA, and only transient/migrant birds have been observed at Bowdoin NWR (MBDD 2006*a*). A Le Conte's sparrow was reported within the BNGPA near the Canadian border in May of 2006 (D. Prellwitz, BLM, unpublished data). Population trend surveys indicate that populations of Le Conte's sparrows are remaining stable. However, they are very elusive and secretive and are poorly surveyed by both the Breeding Bird Survey and the Christmas Bird Count, and these results should be viewed with caution (Lowther 1996). Le Conte's sparrows are of management and conservation concern in Montana primarily because they are relatively rare and have such a limited distribution within the state.

Loggerhead Shrikes breed and winter throughout the United States in a wide variety of open habitats with some shrub or scattered-tree component. Loggerhead shrikes have been observed throughout most of Montana, but reproductive activity is limited primarily to the eastern two-thirds of the state (MTNHP 2006*b*). Loggerhead shrikes are present in Montana from mid-April through the end of September with reproductive activity occurring during the same period. They usually build nests within large shrubs such as sagebrush, bitterbrush, or greasewood (Woods and Cade 1996). Loggerhead shrikes are known to breed within the BNGPA, and nests are usually in Russian olives, buffaloberry, or similar shrubs. Known nest sites are near Nelson Reservoir and north of Bowdoin NWR. Loss of the larger shrub component from many side drainages is negatively impacting the species. Drought, when combined with livestock grazing on an annual basis, is a major factor in the decline. Loggerhead shrike populations have experienced declines across much of their range primarily due to loss of habitat. In addition, loggerhead shrikes are predators whose diet consists largely of insects; therefore, they are prone to the negative effects of pesticide use. Nevertheless, populations in Montana appear to be stable (Casey 2000).

Long-billed Curlews are North America's largest shorebird. They breed in the prairies and grasslands of the northwestern interior of the United States and southwestern Canada and winter on the gulf coast, southern California, and western Mexico (Casey 2000). Long-billed curlews breed throughout Montana (MTNHP 2006*b*). They are present in Montana from mid-April through mid-September, and reproductive activity occurs during the same time period. They prefer gentle, rolling topography in native grasslands, sagebrush, and agricultural lands that can be arid as long as a water source is relatively nearby. Vegetation species composition appears to be less limiting than does vertical structure (Casey 2000). Long-billed curlews breed within the BNGPA and nest in short- and mid-grass areas from Nelson Reservoir north past Whitewater and Loring to the Canadian border. Immature birds have been banded near Nelson Reservoir, Hewitt Lake, and Whitewater Lake. An immature long-billed curlew that had been banded at Hewitt Lake was observed near Nelson Reservoir as an adult in a subsequent year. Long-billed curlew was formerly a candidate species for the threatened and endangered list; it is of management and conservation concern because of population declines attributed to the loss of suitable nesting habitat. Breeding habitat in Montana is considered fragmented and remains largely unprotected (Casey 2000).

McCown's Longspurs are short-grass prairie specialists and breed primarily in the short-grass prairies of Wyoming, Montana, southern Alberta and Saskatchewan and winter primarily in west Texas and north central Mexico (With 1994). McCown's longspurs breed throughout the eastern two-thirds of Montana (MTNHP 2006*b*). They are present in Montana from mid-April through mid-November, and breeding and brood-rearing occurs during the same time period. McCown's longspurs prefer open habitats with sparse vegetation and do well in areas that have been grazed (With 1994). They are present consistently on linear songbird transects conducted since 1979 in northern Phillips County, but distribution within transects is highly correlated to areas of intense grazing. Territorial males frequently are heard or observed during gas well staking tours in proximity to proposed and existing gas wells; however, no nests have been discovered during nest-dragging prior to well and pipeline development. Nevertheless, adult McCown's longspur behavior has indicated probable nests or broods quite close to some wells. Though populations of McCown's longspurs have decreased substantially since historic levels in the early 20th century, short-term population trends indicate populations may have stabilized over much of their range (With 1994, Sauer et al. 2005). Population declines were most likely caused by the conversion of native short-grass prairies to other uses (With 1994). McCown's longspur remains a species of management and conservation concern because of the continued pressure to

convert native prairies. Montana is particularly important to the conservation of this species as it provides a large portion of the existing breeding habitat (Casey 2000).

Mountain Plovers are dependent on short-grass prairie and also are considered near prairie-dog obligates (Knowles et al., 1982). Mountain plovers breed on the plains of southern Canada, central Montana, Wyoming, and eastern Colorado and winter in the central valley of California and northern Mexico (Sibley 2000). Mountain plovers are found east of the continental divide primarily in north-central Montana (MTNHP 2006*b*). Mountain plovers are present within Montana from the beginning of April through September, and reproductive activities occur from mid-May through the end of August. Mountain plovers nest on the ground in large grassland areas with short, sparse vegetation and substantial amounts of bare ground (Casey 2000). The distribution pattern of mountain plovers in Montana is associated with blue grama grass and black-tailed prairie-dog colonies (Knowles et al. 1982). They have been observed at Hewitt Lake NWR within the BNGPA, and at Bowdoin NWR just outside of the BNGPA (Prellwitz 1993). The mountain plover observed at Hewitt Lake was in a black-tailed prairie-dog colony with natural gas wells, but was most likely a transient bird migrating through the area (Figure 3.13-1). The mountain plover observed in Bowdoin NWR was not in a prairie-dog colony. Additional black-tailed prairie-dog colonies near Nelson Reservoir might also attract mountain plovers on occasion. Mountain plovers may breed within the BNGPA where suitable habitat exists. However, direct evidence of breeding only exists to the south and southwest of the BNGPA, which is consistent with the extent of the black-tailed prairie-dog complex in the area. Mountain plover was formerly a candidate species for the threatened and endangered list. Mountain plovers are of management and conservation concern because of population declines attributed to the loss of habitat across their range (Casey 2000).

Nelson's Sharp-tailed Sparrows breed throughout portions of Alberta, Saskatchewan, Manitoba, North Dakota, and Montana and winter along the coastal areas of the southeastern United States (Greenlaw and Rising 1994). In Montana, Nelson's sharp-tailed sparrows have a very limited distribution. Nelson's sharp-tailed sparrows have been documented only in the northeastern corner of the state, though transient/migrant birds have been observed around the Bozeman vicinity (MTNHP 2006*b*). Information on the presence of Nelson's sharp-tailed sparrows in Montana is limited. They have been observed within Montana in May, June, July, and August. They nest in colonies and prefer freshwater wetlands with dense, emergent vegetation comprised of prairie cordgrass and common reed stands (Murray 1969). Nelson's sharp-tailed sparrow have not been observed within the BNGPA. A recent sighting in Valley County, although outside of the BNGPA, is the closest known occurrence of the species. Potential habitat for the species is very uncommon within the BNGPA but may exist at Bowdoin NWR outside of the BNGPA. It is possible, but unlikely, that Nelson's sharp-tailed sparrows could be found within the BNGPA based on their habitat preference and extremely limited distribution within Montana. Nelson's sharp-tailed sparrows are of management and conservation concern in Montana primarily because they are relatively rare and have such a limited distribution within the state.

Northern Goshawks are uncommon but widespread birds of prey found throughout Canada and the northern and western United States. Northern goshawks have been observed throughout much of Montana, but most observations and breeding activity occur in the western third and the southern edge of the state. They are present in Montana year-round but breed and rear young from mid-May through mid-August. The preferred habitat of northern goshawks is coniferous forest. Nest sites in the drier Rocky Mountains are located in predominantly even-aged stands with higher stem densities and lower shrub cover than nest sites in mature or old-growth forests of the moister Pacific Northwest (Hayward and Escano 1989). Northern

goshawks do not breed in the BNGPA and are absent during the summer months. They are present in the fall and winter months within and just outside of the BNGPA where they are observed regularly. Northern goshawks have been observed during annual Christmas Bird Counts conducted at McNeil Slough (three of seven years from 2000–2006) and Bowdoin NWR (18 of 22 years from 1985–2006; Audubon 2006*a*, *b*). Goshawks at Bowdoin NWR feed on ring-necked pheasants during fall and winter. Northern goshawks are of management and conservation concern in Montana because of nesting habitat fragmentation. Goshawk populations in Montana are currently stable or increasing (Casey 2000).

Northern Hawk Owls are almost entirely restricted to Canada and Alaska, but incidental observations of transient birds occur in the northern United States (Sibley 2000). Northern hawk owls have a very limited distribution in Montana. Observations are restricted primarily to northern Montana, and the majority of sightings are of transient/migrant birds (MTNHP 2006*b*). Northern hawk owls inhabit northern coniferous forests, a habitat type that does not exist in the BNGPA. A sighting of a northern hawk owl during winter in the BNGPA would be very unusual, but not impossible. Northern hawk owls are of management and conservation concern in Montana primarily because they are very rare.

Olive-sided Flycatchers breed in the mountains of western North America and the boreal forest of Canada (Casey 2000, Sibley 2000). Olive-sided flycatchers breed throughout the western third of Montana but are seldom seen in the eastern part of the state except as transients or migrants (MTNHP 2006*b*). They are present in Montana from mid-May through the end of August and breed during the same time period. Olive-sided flycatchers nest in montane or boreal forests. Suitable nesting habitat does not occur within the BNGPA, and olive-sided flycatchers would not be expected to breed in or near the BNGPA. They have been observed around the BNGPA, but the few sightings are from Bowdoin NWR just outside of the BNGPA. Olive-sided flycatchers are of management and conservation concern because of population declines, and loss and fragmentation of suitable nesting habitat (Casey 2000).

Peregrine Falcons breed throughout North America, including the arctic, the Pacific coast and Rocky Mountains, and scattered areas across the eastern United States. They have been seen throughout Montana, and records of breeding are scattered across the state (MTNHP 2006*b*). Peregrine falcons are present in Montana year-round, but reproductive activity occurs from the beginning of May through mid-September. They nest on large cliffs near riparian habitats with abundant, medium-sized avian prey. It is unlikely that peregrine falcons breed within the BNGPA. However, transient or migrant individuals are observed occasionally. Peregrine falcons are found around large water areas such as Nelson Reservoir during the migration seasons, and occasionally during winter. They have been observed on Christmas Bird Counts at Bowdoin NWR and McNeil Slough (Audubon 2006*a*, *b*). A peregrine falcon spent the summer in Bowdoin NWR a number of years ago, and more than likely hunted within the BNGPA. A sick, banded bird that had been captured at Bowdoin NWR, rehabilitated and released, was recaptured two weeks later in Texas. Peregrine falcons formerly were classified as endangered but were delisted in 1999. They are of management and conservation concern because of historic population declines due to negative effects of pesticides. Peregrine falcon populations have rebounded and are increasing in areas due to reintroduction efforts and protection of nest sites (Casey 2000).

Red-headed Woodpeckers are found primarily in the eastern United States, but also occur in riparian and wooded areas across the Great Plains (Sibley 2000). Red-headed woodpeckers have been observed throughout most of Montana, but breeding activity is restricted to the eastern half of the state (MTNHP 2006*b*). Red-headed woodpeckers are present in Montana

from mid-May through the end of August, and reproductive activity occurs during the same period. They prefer open and park-like areas of forest with abundant decadent trees or snags for nesting. Red-headed woodpeckers are known to breed within the BNGPA. Observations in the spring within the BNGPA usually occur in late May or early June. Nesting activity once was quite active along the Milk River in the Milk River Unit, but suitable nesting habitat has been reduced in recent years. Human disturbance, such as gas well development and activity, could be a factor in declining nesting activity along the Milk River. Red-headed woodpecker is a species of management and conservation concern due to the loss of mature trees in riparian areas for nesting and because the populations have been largely unmonitored (Casey 2000).

Sage Thrashers are sagebrush obligates found throughout the intermountain west. They breed throughout much of southern Montana with only scattered observations in northern portions of the state (MTNHP 2006*b*). Sage thrashers are present in Montana from the middle of April through the end of August. Reproductive activity occurs during the same period. They build nests in shrub steppe communities dominated by big sagebrush. Suitable habitat is limited within the BNGPA, and it is unlikely that sage thrasher breeding occurs there. Most breeding observations of sage thrasher are entirely outside of the BNGPA and were recorded during the South Malta Breeding Bird Survey along a route that runs from six miles south of Malta southeast to the Content Area. Sage thrashers occur mostly in dense stands of big sagebrush about 16 miles south of the BNGPA. A few individuals have been observed at other locations farther south in Phillips County, but population density is so sparse that it is difficult to find sage thrashers in some years. Sage thrasher is a species of management and conservation concern because of the loss and fragmentation of big sagebrush communities (Casey 2000).

Sedge Wrens breed in central Canada and the upper Midwest and Great Lakes region of the United States. They have primarily been documented as transients or migrants in Montana although indirect evidence of breeding has occurred in the far northeastern portion of the state (MBDD 2006*e*). Sedge wrens have been recorded in Montana from April to September (MBDD 2006*e*, MTNHP 2006*b*). They prefer damp areas with dense grass and scattered shrubs either in, or adjacent to, wetlands (Sibley 2000, MTNHP 2006*b*). Sedge wrens display low nest-site tenacity and variability in breeding area occupancy because of the relatively high instability (due to flooding or drought) of their preferred habitat (MTNHP 2006*b*). Sedge wrens have been documented in Bowdoin NWR, but should be considered rare transients (USFWS 1999). Sedge wren is of management and conservation concern in Montana primarily because it is a wetlands-associated species, is relatively rare, and has such a limited distribution within the state.

Sprague's Pipits breed in central Canada, Montana, and North Dakota and migrate through the interior United States to winter in Texas and Mexico (Sibley 2000). They have been documented breeding throughout much of the eastern two-thirds of Montana (MTNHP 2006*b*). Sprague's pipits are present in Montana from the beginning of May through the end of August. Breeding and brood-rearing activities occur during the same period. Sprague's pipits prefer native prairie grasslands of intermediate density and moderate height and variation, but also will use pastures subjected to light to moderate grazing (Casey 2000). Sprague's pipits nest throughout the BNGPA, and territorial males often display above participants in gas-well staking tours. Their nests are encountered regularly when well pads and pipeline routes are being nest-dragged prior to construction during the summer nesting season. One nest was found while a pipeline was being nest-dragged near the Canadian border during 2005. Bowdoin NWR just outside of the BNGPA possesses a large data set for Sprague's pipit nests for the period of 1994 through 2006. Sprague's pipit remains a species of management and conservation concern because of continued pressure to convert native prairies. Montana is particularly important to the

conservation of this species as it provides a large portion of the existing breeding habitat (Casey 2000).

Swainson's Hawks are birds of prey that are known for their long-distance migratory behavior. They breed throughout the western United States and winter in South America. Swainson's hawks have been documented breeding throughout Montana (MTNHP 2006*b*). They are present in Montana from mid-April through mid-September, and reproductive activity occurs during the same period. They prefer open habitats and nest in isolated tree groves or solitary trees. At least five Swainson's hawk nests are located within the BNGPA (Figure 3.12-7). Four nests were found during aerial surveys in 2006, and another is located along the county road southwest of Whitewater (HWA, unpublished data; BLM, unpublished data). Several Swainson's hawk nest sites are located around Bowdoin NWR just outside of the BNGPA. Populations seem to be increasing in Montana and across the species' range; however, high mortality on winter range in South America remains a concern (Casey 2000).

White-faced Ibises are colonial nesting waterbirds that breed in localized colonies found scattered across the western United States (Casey 2000, Sibley 2000). They have a very limited distribution in Montana, and breeding records exist for only four counties (MTNHP 2006*b*). White-faced ibises are present in Montana from the beginning of April through mid-September, and breeding occurs from the beginning of May through mid-August. The white-faced ibis' preferred habitat consists of permanent, shallow wetlands with emergent vegetation, but this species also will use irrigated croplands for foraging. No breeding colonies are known to exist within the BNGPA. However, white-faced ibises do breed in Bowdoin NWR and often feed in irrigated pastures near the refuge and occasionally within the BNGPA during late summer during the brood-rearing period. White-faced ibis is a species of management and conservation concern because like other colonial nesting species, its colonies are susceptible to fluctuating water levels and disturbance. In addition, only a few nesting colonies are known to exist in Montana, and populations are declining throughout the United States (Casey 2000).

Yellow Rail is a small, secretive species that breeds in Canada and the northern United States and winters in California and on the gulf coast (Sibley 2000). Yellow rails are considered rare in Montana with fewer than 20 observations in the state (MTNHP 2006*b*). Yellow rails have occurred in Montana from May to late October. Most observations are of transient/migrant birds, but indirect evidence of breeding has been recorded in extreme northeastern Montana. Yellow rails have been observed on several occasions at Bowdoin NWR, and have the potential to occur in the BNGPA. An individual was caught in a duck-banding trap in late summer, and another was observed at close range in a marsh in early fall at Bowdoin NWR just outside of the BNGPA. Most of the BNGPA does not have large enough areas of marsh habitat to attract yellow rails. They are of management and conservation concern in Montana primarily because they are relatively rare, have a limited distribution within the state, and are susceptible to fluctuating water levels and disturbance (Casey 2000).

Yellow-billed Cuckoos (Eastern Population) are Neotropical migrants that breed across the eastern United States and winter primarily in South America. Transient individuals that have been documented in the southwestern portion of the state are probably members of the western population (MTNHP 2006*b*). Yellow-billed cuckoo is considered a riparian-obligate species requiring mature riparian woodland, especially cottonwood (*Populus* spp.) or willow (*Salix* spp.), with low, dense undergrowth at elevations below 7,000 feet. Yellow-billed cuckoos have been documented in Bowdoin NWR but should be considered rare transients (USFWS 1999). Yellow-billed cuckoos are of management and conservation concern in Montana primarily because they

are a riparian-associated species, are relatively rare, and have such a limited distribution within the state.

Amphibians

Plains Spadefoot is a prairie species known for its ability to quickly cover itself by burrowing into the soil using a unique morphological feature (i.e., 'spade') on its hind legs. It is primarily associated with sandy soils and gravel-loams (Werner et al. 2004). Plains Spadefoots have been known to disperse more than a mile but normally are found within a few hundred meters of their breeding site (Werner et al. 2004). A lack of large areas of sandy soils in the BNGPA probably greatly restricts the population of the species.

Great Plains Toads are primarily found at the headwaters of drainages and in glacial potholes, irrigation ditches, and smaller coulees (Werner et al. 2004). They are good burrowers and spend a considerable amount of time underground during hot, dry periods. During drought they sometimes use prairie-dog burrows to escape the heat. Individuals are known to travel approximately a mile from their breeding sites to forage (Werner et al. 2004). Toads are rarely observed in the BNGPA because they are most easily seen after summer rain storms when roads are impassable and people are not in toad habitat.

Northern Leopard Frogs are not usually found far from wetlands, cattail marshes, or along vegetated shorelines during summer, but they will venture several hundred meters along wet drainages during wet periods (Werner et al. 2004). Nevertheless, northern leopard frogs are known to travel up to five miles during spring and fall migration and during juvenile dispersal (Werner et al. 2004). Northern leopard frogs are most common near large, deep reservoirs scattered across the BNGPA where water persists throughout drought periods (Figure 3.12-9). Reservoirs with fish often have leopard frogs (D. Prellwitz, BLM, personal communication). Although these frogs are fairly common in the BNGPA, they may be exposed to similar factors that are causing declines west of the Continental Divide (Werner et al. 2004).

Reptiles

Greater Short-horned Lizards are cryptically colored and secretive. They are found in sagebrush and short-grass prairie habitats usually on south-facing slopes, rocky rims, and shale outcrops (Werner et al. 2004). They are sit-and-wait predators that only move about three meters per day. They are prey to snakes, hawks and owls, and escape or hide from these predators in sagebrush, under rocks, or in burrows (Werner et al. 2004). Short-horned lizards are most common in the breaks along Cottonwood Creek and Little Cottonwood Creek near the western edge of the BNGPA (Figure 3.12-9).

Western Hog-nosed Snakes use well-drained, sandy soils found along exposed riverbanks, sandstone outcrops, and old riverbeds (Werner et al. 2004). Western hog-nosed snakes can move several hundred meters in a day. They specialize in amphibian prey such as salamanders, frogs, and toads that they locate by olfactory cues (Werner et al. 2004). The species over-winters in underground cavities and mammal burrows (Werner et al. 2004). A western hog-nosed snake has been documented in Martins Coulee, but otherwise this species is uncommon in the BNGPA due to a lack of sandy soils. There is one record from Bowdoin NWR which is immediately adjacent to the BNGPA.

Fish

Paddlefish habitat includes slow or quiet waters of large rivers or impoundments. The species spawns on the gravel bars of large rivers during spring high water. Paddlefish tolerate, and may prefer, turbid water. Paddlefish stocks in Montana are adequate to support a recreational fishery.

Pearl Dace is a native species of both the eastern and northern drainages in Montana. Pearl dace prefer small cool streams, either clear or turbid. They spawn in clear water at depths of one to two feet over a gravel or sand bottom.

Sauger are native to Montana east of the Continental Divide. They inhabit both large rivers and reservoirs but are mainly a river fish. Sauger broadcast their spawn over riffles in rivers in the spring. Sauger are a highly prized sport fish; in some areas outside Montana they are also commercially fished.

Shortnose Gar is the only representative of the gar family in Montana. It is typically found in large rivers, quiet pools, backwaters, and oxbow lakes. This fish is native to Montana, but is found at only one location: the dredge ponds below Fort Peck Reservoir. Shortnose gar are of management and conservation concern in Montana because of their restricted distribution and limited population size.

Plants

Chaffweed (formerly *Centunculus minimus*) is a low annual herb inhabiting vernally wet and sparsely vegetated soils around ponds, rivers, and streams in the valleys and plains throughout Montana (MNHP 2006*e*). The flowering/fruiting period of chaffweed is June through September. Chaffweed is known to occur in Phillips and Valley counties and in the BNGPA (Taylor 2006).

Dwarf woolly-head is a low annual herb inhabiting drying mud of ponds and other vernally wet soil in valleys and plains (MNHP 2006*e*). Mature fruit is produced June to early August. Dwarf woolly-head is known to occur in the BNGPA (Taylor 2006).

Hot spring phacelia is an annual herb inhabiting open to partially wooded settings. This species has been collected on level ground adjacent to steep slopes above coulees (MTNHP 2006*e*). The Montana Natural Heritage Program records show that it was documented in the southern part of the BNGPA in 1982.

Long-sheath waterweed (formerly *Elodea longivaginata*) is an aquatic perennial herb inhabiting the shallow water of ponds and lakes on the plains with a flowering period of late June/July (MNHP 2006*e*). Long-sheath waterweed is known to occur on public land administered by the Malta Field Office, and the MNHP indicates it was observed in the southern part of the BNGPA in 1984.

Roundleaf water-hyssop is a perennial aquatic herb inhabiting muddy shores of ponds and streams in the valleys and on the plains with a flowering/fruiting period of June-August (MNHP 2006*e*). Roundleaf water-hyssop is known to occur in the BNGPA (Taylor 2006).

Scarlet ammannia (formerly *Ammania coccinea)* is a branching annual up to 4 decimeters tall, often inhabiting alkaline wet places throughout North America (Cronquist et al. 1997). Historical records maintained by the MNHP indicate this species was recorded just outside of the project

area on the Bowdoin National Wildlife Refuge in 1903. Subsequent surveys have not recorded the presence of this species, and there is a possibility the plant may have been misidentified during the original survey.

Slender-branched popcorn flower is an annual herb inhabiting drying mud of ponds and other vernally wet soil in valleys and plains. The flowering/fruiting period usually occurs in July-August (MNHP 2006*e*). Slender-branched popcorn flower has been documented in Phillips County and is known to occur in the BNGPA (Taylor 2006).

Slender bulrush (formerly *Scirpus heterochaetus*) is a tall grass-like perennial rush inhabiting marshes and edges of lakes and ponds on the plains with fruiting usually occurring in August (MNHP 2006*e*). Slender bulrush is known to occur on the project area (Taylor 2006).

Table 3.13-3. Occurrence Potential, Status, and Associations of Montana Animal Species of Concern present in the BNGPA

Common Name[1]	Scientific Name	Occurrence Potential[2]	Global and State Status[3]	FWS[4]	BLM[5]	Habitat Association[6]	Other Association[7]
Mammals							
Black-footed Ferret	*Mustela nigripes*	VU	G1/S1	E,XN		grasslands	Prairie Dog Colonies
Black-tailed Prairie Dog	*Cynomys ludovicianus*	P	G4/S3	C	S	grasslands	Prairie Dog Colonies
Preble's Shrew	*Sorex preblei*	pp	G4/S3		S	sagebrush/grasslands	Sagebrush obligate
Swift Fox	*Vulpes velox*	P	G3/S3		S	grasslands	Prairie Endemic
Townsend's Big-eared Bat	*Corynorhinus townsendii*	U	G4/S2		S	caves in forest	
Birds							
Alder Flycatcher	*Empidonax alnorum*	pp	G5/S1B			wetlands/shrublands	Wetlands
American White Pelican	*Pelecanus erythrorhynchos*	P	G3/S3B			lakes	Colonial Nesting Waterbird
Baird's Sparrow	*Ammodramus bairdii*	P	G4/S2B		S	grasslands	Prairie Endemic
Bald Eagle	*Haliaeetus leucocephalus*	P	G4/S3B,N		S	riparian forest	Raptor
Black Tern	*Chlidonias niger*	P	G4/S3B		S	wetlands	Colonial Nesting Waterbird
Black-and-white Warbler	*Mniotilta varia*	VU	G5/S2,S3B			deciduous forest	Riparian
Black-crowned Night-heron	*Nycticorax nycticorax*	P	G5/S3B			wetland-lake w/ emergent vegetation	Colonial Nesting Waterbird
Bobolink	*Dolichonyx oryzivorus*	P	G5/S2B			moist grassland	Intermediate-Tall Grassland
Brewer's Sparrow	*Spizella breweri*	pp	G5/S2B			sagebrush	Sagebrush steppe obligate
Burrowing Owl	*Athene cunicularia*	P	G4/S2B		S	grassland	Prairie Dog Colonies
Caspian Tern	*Sterna caspia*	P	G5/S2B			large rivers and lakes	Colonial Nesting Waterbird
Chestnut-collared Longspur	*Calcarius ornatus*	P	G5/S3B			grassland	Prairie Endemic
Common Loon	*Gavia immer*	P	G5/S2B		S	mountain lakes w/ emergent vegetation	Wetlands
Common Tern	*Sterna hirundo*	P	G5/S3B			large rivers and lakes	Colonial Nesting Waterbird
Ferruginous Hawk	*Buteo regalis*	P	G4/S2B		S	sagebrush/grasslands	Prairie Endemic
Forster's Tern	*Sterna forsteri*	pp	G5/S2B			wetlands	Colonial Nesting Waterbird
Franklin's Gull	*Larus pipixcan*	P	G4G5/S3B			wetland-lake w/ emergent vegetation	Colonial Nesting Waterbird
Grasshopper Sparrow	*Ammodramus savannarum*	P	G5/S3B			grassland	Intermediate-Tall Grassland
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*	P	G5/S2B,S5N			alpine	
Greater Sage-Grouse	*Centrocercus urophasianus*	P	G4/S3		S	sagebrush	Sagebrush obligate
Harlequin Duck	*Histrionicus histrionicus*	pp	G4/S2B		S	mountain streams	
Interior Least Tern	*Sterna antillarum athalassos*	P	G4T2Q/ S1B	E		large prairie rivers	Colonial Nesting Waterbird
Lark Bunting	*Calamospiza melanocorys*	P	G5/S3B			sagebrush/grasslands	Prairie Endemic
Le Conte's Sparrow	*Ammodramus leconteii*	P	G4/S1S2B		S	prairie wetlands	Wetlands
Loggerhead Shrike	*Lanius ludovicianus*	P	G4/S3B		S	shrublands	Intermediate-Tall Grassland
Long-billed Curlew	*Numenius americanus*	P	G5/S2B		S	grassland	Prairie Endemic
McCown's Longspur	*Calcarius mccownii*	P	G5/S2B			grassland	Prairie Endemic
Mountain Plover	*Charadrius montanus*	P	G2/S2B			grasslands	Prairie Dog Colonies
Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*	U	G5/S1B			prairie wetlands	Wetlands
Northern Goshawk	*Accipiter gentilis*	P	G5/S3		S	mixed conifer forest	Raptor
Northern Hawk Owl	*Surnia ulula*	VU	G5/S1B,S1N			conifer forest	Raptor
Olive-sided Flycatcher	*Contopus cooperi*	U	G4/S3B			early seral forest/shrub patches	
Peregrine Falcon	*Falco peregrinus*	P	G4/S2B		S	cliffs	Raptor
Piping Plover	*Charadrius melodus*	P	G3/S2B	T		prairie lake and river shorelines	Wetlands
Red-headed Woodpecker	*Melanerpes erythrocephalus*	P	G5/S3B			riparian forest	Riparian
Sage Thrasher	*Oreoscoptes montanus*	U	G5/S3B			sagebrush	Sagebrush obligate
Sedge Wren	*Cistothorus platensis*	U	G5/S1B		S	prairie wetlands	Wetlands

Common Name[1]	Scientific Name	Occurrence Potential[2]	Global and State Status[3]	FWS[4]	BLM[5]	Habitat Association[6]	Other Association[7]
Sprague's Pipit	*Anthus spragueii*	P	G4/S2B			grasslands	Prairie Endemic
Swainson's Hawk	*Buteo swainsoni*	P	G5/S3B		S	sagebrush/grasslands	Raptor
White-faced Ibis	*Plegadis chihi*	P	G5/S1B		S	wetland-lake w/ emergent vegetation	Wetlands
Whooping Crane	*Grus americana*	P	G1/S1M	E		wetlands	Wetlands
Yellow Rail	*Coturnicops noveboracensis*	pp	G4/S1B			wetlands	Wetlands
Yellow-billed Cuckoo (E. Pop.)	*Coccyzus americanus*	U	G5/S3B			prairie riparian forest	Riparian
Amphibians							
Great Plains Toad	*Bufo cognatus*	pp	G5/S2		S	wetlands, floodplain pools	Wetlands
Northern Leopard Frog	*Rana pipiens*	P	G5/S3		S	wetlands, floodplain pools	Wetlands
Plains Spadefoot	*Spea bombifrons*	pp	G5/S3		S	wetlands, floodplain pools	Wetlands
Reptiles							
Sagebrush Lizard	*Sceloporus graciosus*	VU	G5/S3			rock outcrops	Sagebrush obligate
Western Hog-nosed Snake	*Heterodon nasicus*	P	G5/S2		S	floodplain friable soils	Wetlands
Greater Short-horned Lizard	*Phrynosoma hernandesi*	P	G5/S3		S	sandy/gravelly soils	Sagebrush steppe obligate
Fish							
Paddlefish	*Polyodon spathula*	pp	G4/S1,2		S	large prairie rivers	
Pallid Sturgeon	*Scaphirhynchus albus*	pp	G1/S1	E	S	large prairie rivers	
Pearl Dace	*Margariscus margarita*	P	G5/S2		S	small prairie streams	
Sauger	*Stizostedion canadense*	P	G5/S2		S	large prairie rivers	
Shortnose Gar	*Lepisosteus platostomus*	pp	G5/S1		S	large prairie rivers	
Plants							
Chaffweed	*Anagallis minima*	P	G5/S2		S	wetlands	Wetlands obligate
Dwarf Woolly-heads	*Psilocarphus brevissimus*	P	G4/S1		S	wetlands	Wetlands obligate
Hot Spring Phacelia	*Phacelia thermalis*	pp	G3G4/S1		pS	open areas and scattered woodlands	
Long-Sheath Waterweed	*Elodea longivaginata*	P	G4G5/S2		S	aquatic	Wetlands obligate
Roundleaf Water-hyssop	*Bacopa rotundifolia*	P	G5/S1		pS	aquatic	Wetlands obligate
Scarlet Ammannia	*Ammannia robusta*	pp	G5/SH			alkaline wetlands	Wetlands obligate
Slender-branched Popcorn Flower	*Plagiobothrys leptocladus*	P	G4/S1		S	wetlands	Wetlands obligate
Slender Bulrush	*Schoenoplectus heterochaetus*	P	G5/S1		S	wetlands	Wetlands obligate

[1] (MTNHP 2006*a*).
[2] Occurrence potential include: present (P), potentially present (pp), unlikely (U), and very unlikely (VU; USFWS 1999, MBDD 2006*a*, *b*; MTNHP 2006*a*; D. Prellwitz, BLM, personal communication).
[3] Global (G) and State (S) Status includes:
- 1: At high risk because of extremely high limited and/or rapidly declining numbers, range, and/or habitat, making it vulnerable to global extinction or extirpation in the state.
- 2: At risk because of very limited and/or declining numbers, range, and/or habitat, making it vulnerable to global extinction or extirpation in the state.
- 3: Potentially at risk because of limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas.
- 4: Uncommon but not rare (although it may be rare in parts of its range), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern.
- 5: Common, widespread, and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range.
- U: Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
- H: Historically occurred; may be rediscovered.
- B/N: Breeding status for a migratory species includes: Breeding (B), Non-breeding (N).
- M: A state rank modifier indicating migratory stopover status for a species.
- Q: A global rank modifier indicating that there are taxonomic questions or problems.
- T: Denotes the rank for a subspecific taxon (subspecies or population); appended to the global rank for the full species.

[4] FWS ESA status includes: Endangered (E); Threatened (T); and Experimental Non-essential (XN; USDI-FWS 2004).
[5] BLM Status (BLM Manual 6840 BLM 2004) includes: Proposed Sensitive (pS), and Sensitive (S); species that are proven imperiled in at least part of their ranges and are documented to occur on BLM lands.
[6] (MTNHP 2006*a*).
[7] (USFWS 1988, Feigley 1998, Miller et al. 2000, Lenard et al. 2006, MTNHP 2006*b*, NRCS 2006).

3.14 HEALTH AND SAFETY

3.14.1 Worker Safety

Operating companies in the participating area are required to comply with the Montana Safety Culture Act and the Occupational Safety and Health Act (OSHA). The participating companies have a variety of policies, safe work practices and training programs in place for compliance with these regulatory programs and to safeguard employee health. Their contractors are expected to implement similar programs. In Montana, for fiscal year 2004, the greatest number of reported accidents were strains followed by slips, trips and falls and being struck by an object, 29.7 percent, 18.6 percent and 14.1 percent respectively. The oil and gas industry, included in the Mining category, reported strains, being struck by and slips, trips and falls at 26.5 percent, 17.5 percent and 12.4 percent, respectively, as the most common causes of worker injury. Similar accident statistics were reported for the construction industry which would include location, road and pipeline construction contractors (Montana Department of Labor and Industry, 2004). The oil and gas industry has long been known as a hazardous work environment due to the weather conditions, the nature of the equipment (i. e. drilling rigs) and the materials being handled (oil and gas).

3.14.2 Public Health and Safety

The BNGPA is attractive to local residents as a recreation area for such pursuits as bird and big game hunting, open water and ice fishing, snowmobiling and seeking solitude. The area is also home for numerous rural families and their ranching operations.

The roads within the project area see a wide variety of use. BLM and county roads have historically been built to the appropriate standards for the anticipated use, as have the private roads in the area. Roads to individual well sites are generally two-tracks that are used primarily by site workers but may be accessed by bird and big game hunters. In an effort to protect their employees, as well as the public, the participating companies have safe driving policies in place. This topic is more fully discussed in the Transportation section.

The United States Department of Transportation (USDOT) regulates some aspects of gas-gathering and transmission pipelines operated in the field and beyond. USDOT regulations also address the safe transportation of hazardous materials (i. e. drip gas, methanol, drilling mud chemicals, etc) on the national roads and highways. The gas produced in the BNGPA is “sweet,” meaning it does not contain hydrogen sulfide (H_2S), and therefore it does not pose a H_2S hazard to the general public or site workers.

Pipeline and site construction fire-prevention measures are in place during the summer construction season. These include using equipment with spark arrestors, welding in cleared areas only, and the ready availability of fire extinguishers or water trucks in the event fire occurs. BLM requires, and companies implement, extra precautions in the event of drought or high fire danger.

Local and state emergency responders are annually provided information regarding the location and nature of hazardous materials that are held in quantities in excess of their regulatory threshold planning quantity (TPQ) or 10,000 pounds, whichever is greater. These notifications are required of all participating companies and their contractors under the Community Right-to Know Laws (40 CFR 355 and 370, as amended). The participating companies each have an

Emergency Action Response Plan as well as the trained personnel and equipment needed to respond to releases of hazardous materials or other hazardous conditions in the project area.

3.15 NOISE

Noise—unwanted sound—is measured with a decibel meter which has been designed to correspond to the ability of the human ear to detect sound. The A-weighted decibel (dBA) measurement is on a logarithmic scale. The increase in noise or loudness doubles with every 10 dBA increase in the measurement (Bell 1982).

Existing noise levels within the project area are, for the most part, representative of rural conditions and are expected to be between 35 and 45 decibels (Harris 1991), except near county roads and compressor stations where noise levels may be as high as 65 decibels. Noise sources in the project area are primarily natural, such as wind, but additional noise comes from aircraft, traffic on county roads and state highways, operation of the existing gas compression stations, natural gas drilling and production areas, and railroad corridors. Gas pipeline compressor stations in the BNGPA have noise levels ranging from 35 to 67 decibels 500 feet from the station, depending on wind speed and direction, the size of the compression unit, the configuration of the compressor station and the type of muffler installed (WBIP unpublished data, 2005). For comparison purposes residential areas are typically 40 dBA at night and 50 dBA during the day (BLM 2003). The BLM has not established noise standards for the project area. Noise is generally a concern for local residences and for wildlife such as raptors, grouse, big game (winter range), and piping plovers (near Nelson Reservoir nesting sites).

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. NEPA requires an assessment of potential cumulative impacts. Federal regulations (40 CFR 1508.7) define cumulative impacts as:

> "...the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

Potential cumulative impacts are assessed at the resource level. The cumulative impact analysis area (CIAA) for past, present, and reasonably foreseeable future activities (RFFAs) that may generate cumulative impacts varies depending on the resource under consideration. For example, the CIAA for air quality effects is regional in nature; therefore, the scope of activities

considered is necessarily broad. In contrast, the CIAA for geology and minerals considers the project area associated with the Proposed Action and alternatives; therefore, the scope of potential cumulative activities considered is much narrower. Cumulative impacts may result when the environmental impacts associated with a proposed project are added to temporary or permanent impacts associated with past, present, or reasonably foreseeable future projects. Although the individual impact of each separate project might not be significant, the additive impacts of multiple projects could be.

Existing environmental conditions in the project area reflect changes based on past projects and activities. The project area is located in an area in Montana with limited industrial activity other than ongoing natural gas exploration and production. All surface disturbances resulting from the Proposed Action would take place within areas leased for natural gas production. The primary human influences on the project area are natural gas development (including a number of pipelines and compressor stations; see Figure 2.2-1) and livestock grazing.

This discussion of potential cumulative impacts assumes the successful implementation of the environmental protection and mitigation measures discussed in chapters two and four of this EA as well as compliance with the JVRMP and all applicable federal, state, and local regulations and permit requirements.

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 degradation of AQRVs.

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 µg/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 µg/m^3 and 0.003 µg/m^3, respectively, which are well below the PSD Class I increment value for NO_2 of 2.5 µg/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 would 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, 635 federal 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.

Cumulative Impacts

Alternative A impacts would result in an increased volume of hazardous materials being transported into the project area, as well as an increase in the volume of associated waste being disposed of in the area. Additional solid waste generated within the project area would be disposed of at off-site permitted disposal facilities. Produced-water volumes would increase as a result of the increased number of wells operating and the increased number of wells on artificial lift systems. In Alternative A, increased on-site waste disposal would generally be limited to private lands while transportation of materials would occur throughout the project area.

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. 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.

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.

Cumulative Impacts

Alternative B impacts would be greater and more widespread than those identified in Alternative A, resulting in an increased volume of hazardous materials being transported into the project area, as well as an increase in the volume of associated waste being disposed of in the area. Additional solid waste generated within the project area would be disposed of at off-site permitted disposal facilities. Produced-water volumes would increase as a result of the increased number of wells operating and the enhanced number of wells on artificial lift systems. In Alternative B increased on-site waste disposal would occur on private and BLM-managed lands while transportation of materials would occur throughout the project area.

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

Alternative C would result in an increase in drilling and production wastes buried in the BNGPA. Under Alternative C additional federal, state, and fee wells would contribute to the volume of 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 would be 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.

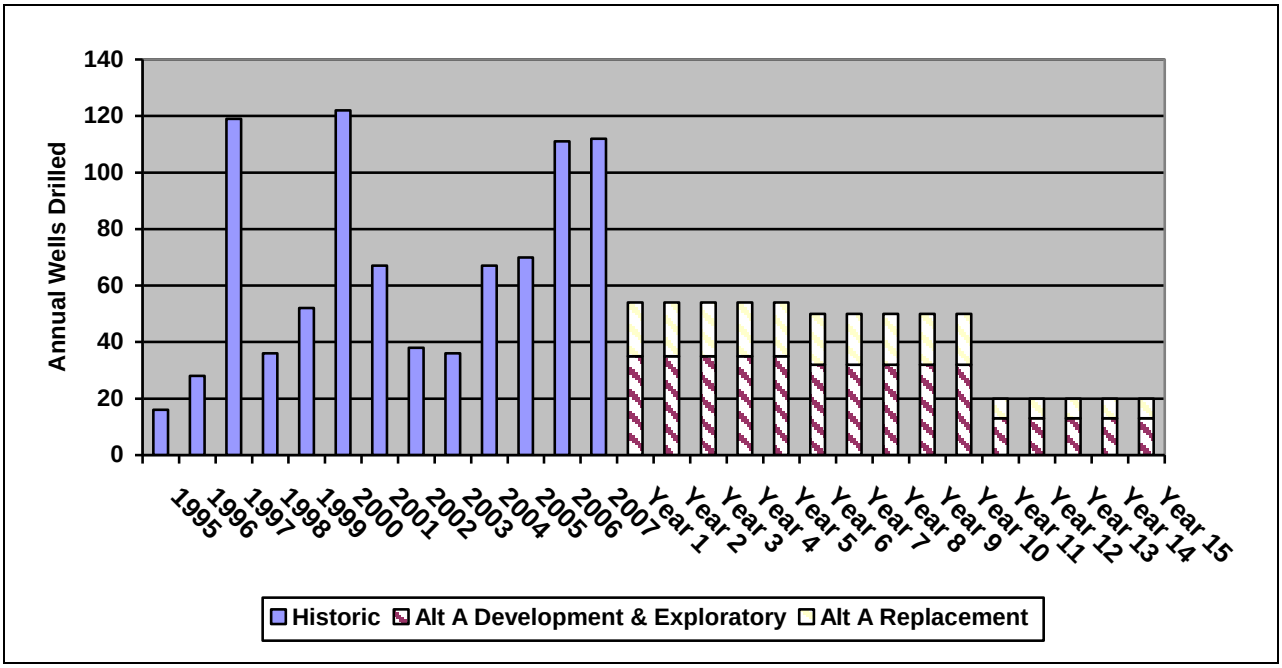
Upon completion of Alternative C, roughly five in 10 of all wells in the field on a cumulative basis would potentially be using artificial lift. This would reinforce the trend of landscape modification in much of the BNGPA. Where PJ equipment is used for artificial lift, Alternative C would potentially 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

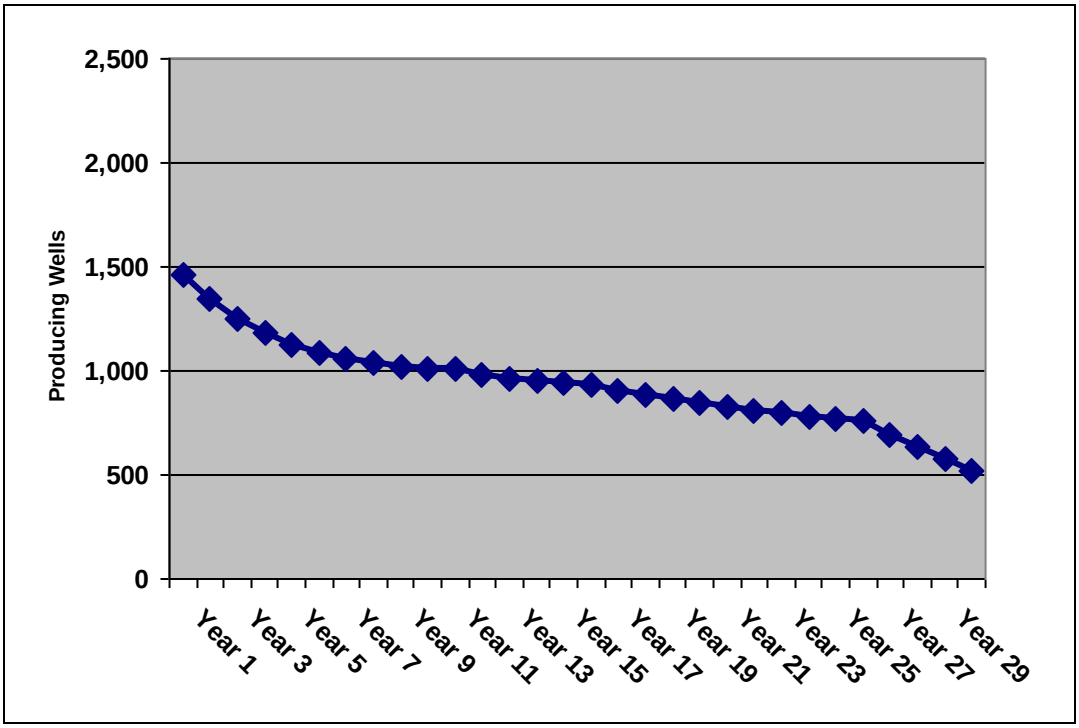


Source: 1995–2005, Bowdoin Operators: 2006 & 2007 Montana board of Oil and Gas:Year 1–15 are averages, prepared by BCLLC based on estimates by the Bowdoin Operators.

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 wells 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]

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

[c] No production is assumed for exploratory wells.

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

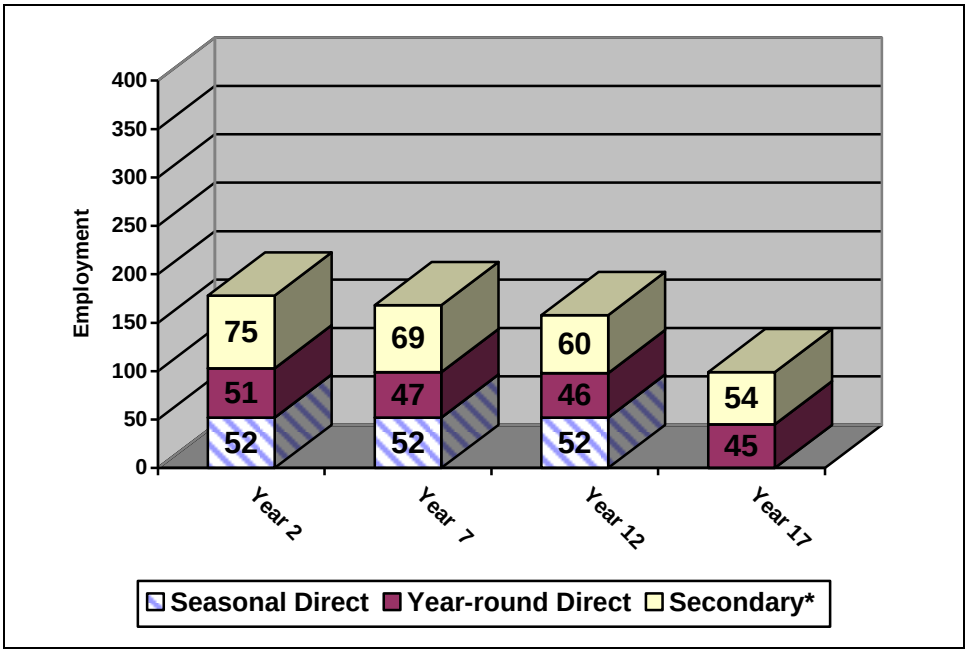
[1] These multipliers are statewide multipliers for Montana
Source: Minnesota IMPLAN Group, 2005

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.

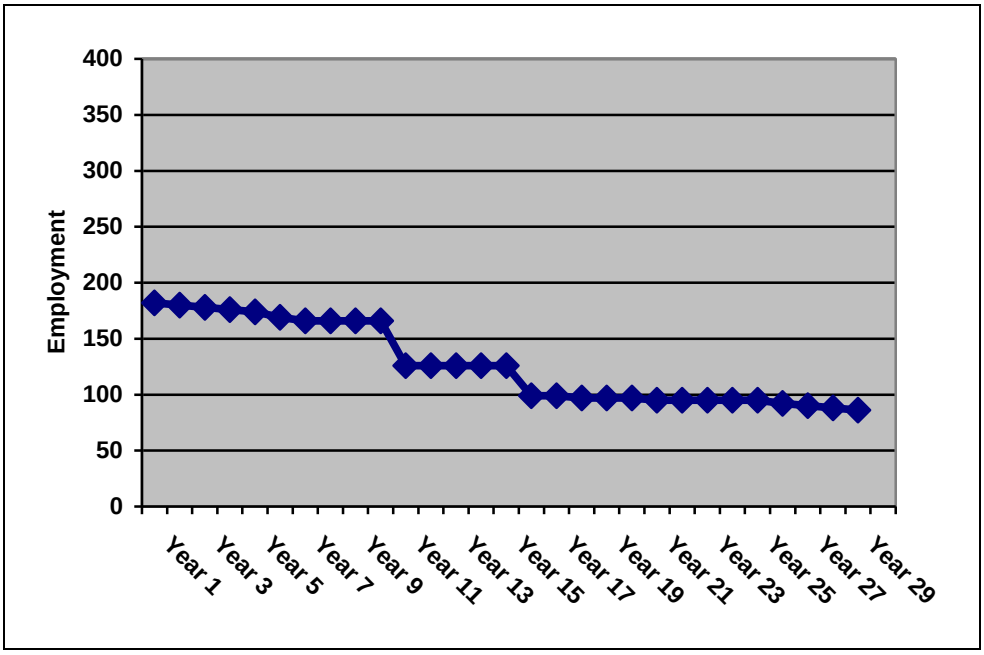
Figure 4.8-3. Estimated Total BNGPA-Related Employment by Category: Alternative A



* 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

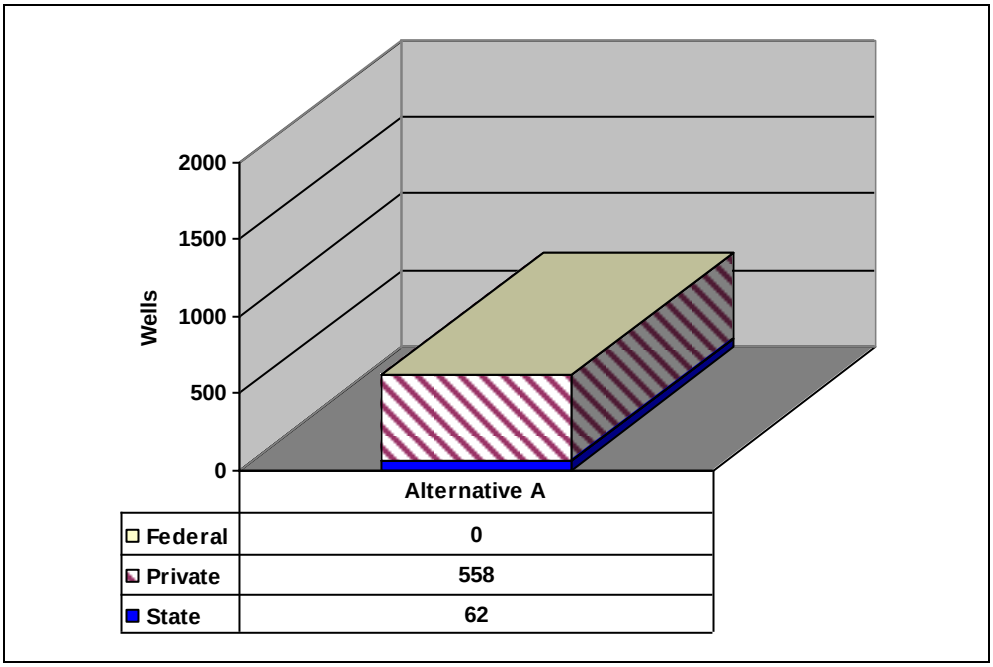
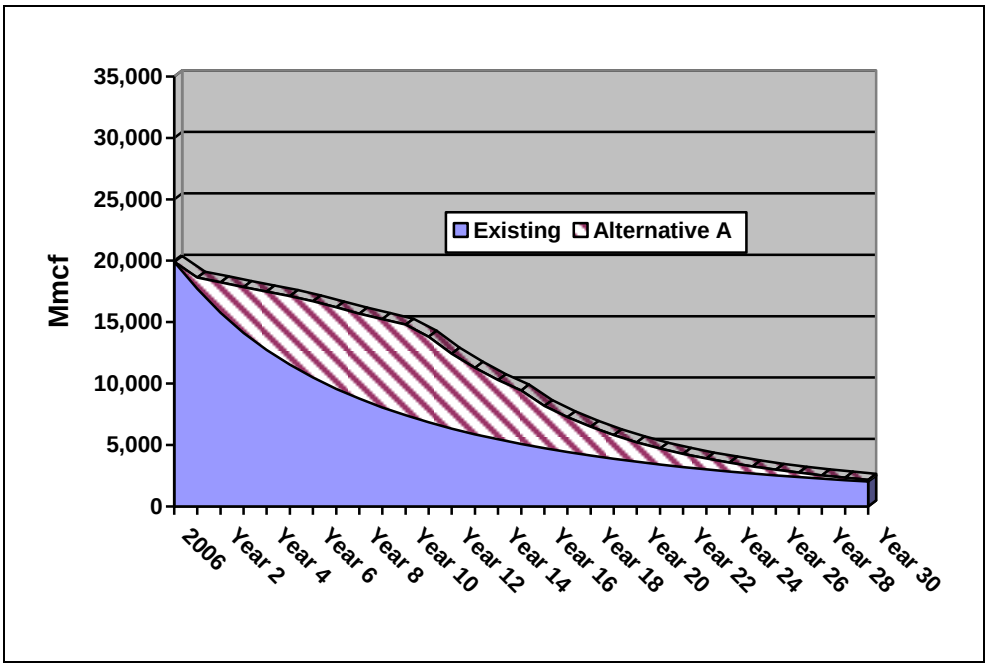


Figure 4.8-6 displays forecast natural gas production from existing BNGPA wells combined with forecast incremental production associated with Alternative A.

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.

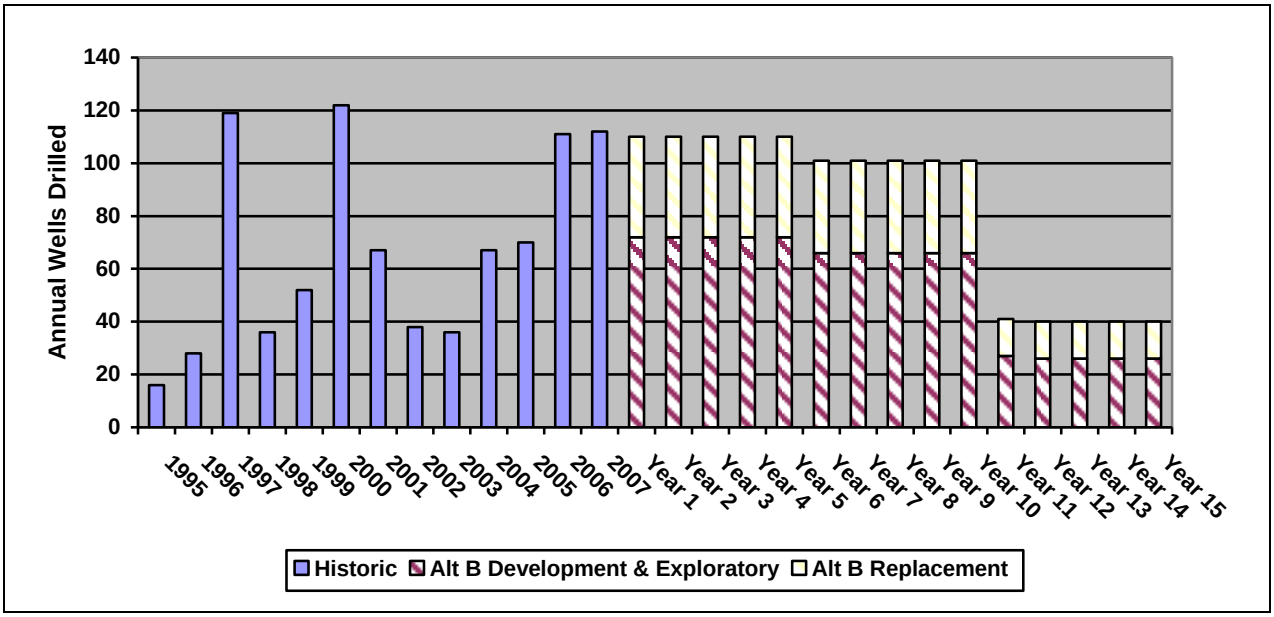
Cumulative Impacts

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).

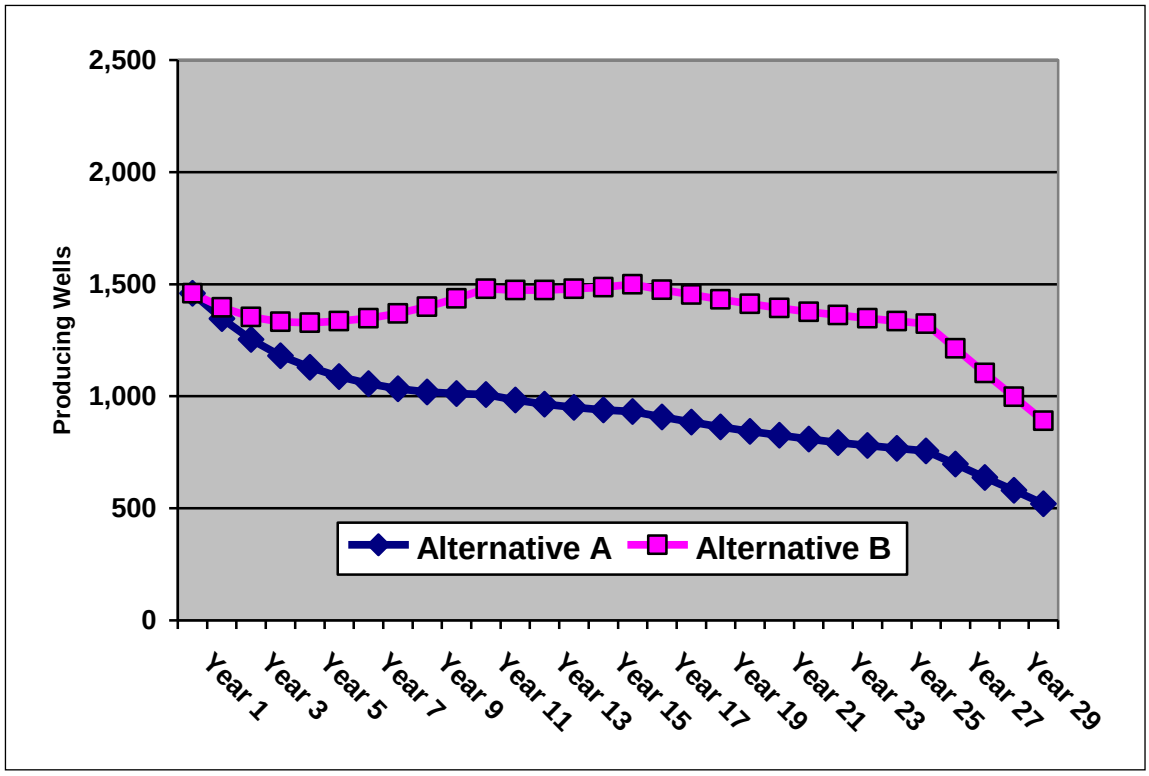
Figure 4.8-7. Historic and Assumed Alternative B Drilling Levels



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

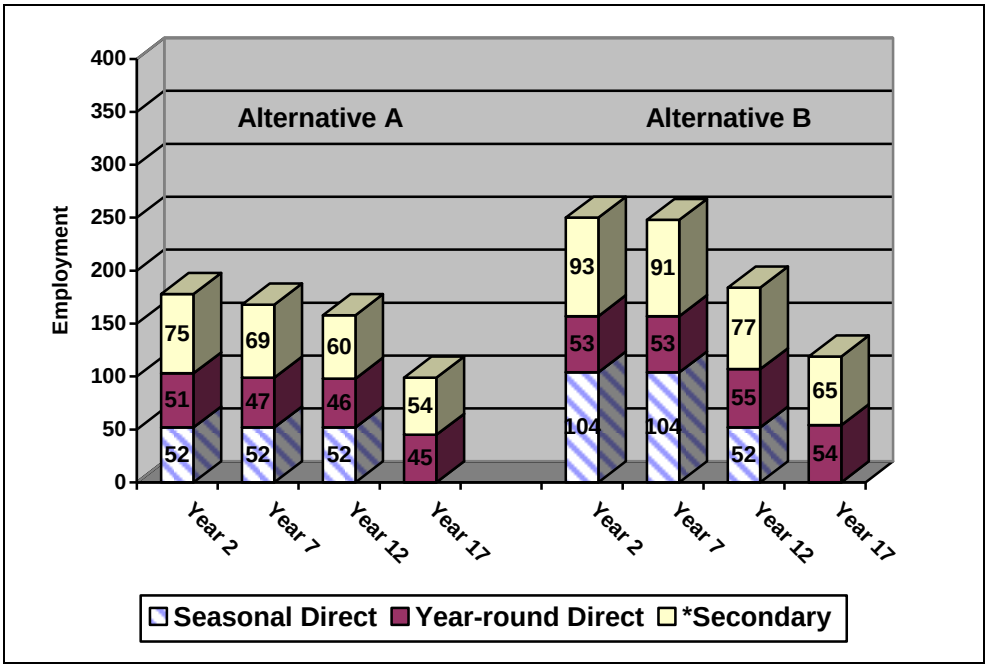
Alternative B would result in a higher pace of drilling activity as compared to Alternative A. Recent drilling levels in the BNGPA have been accomplished with one drilling rig, one completion crew, and one pipeline-construction crew relocating to the area for the duration of each drilling season and 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 natural gas 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

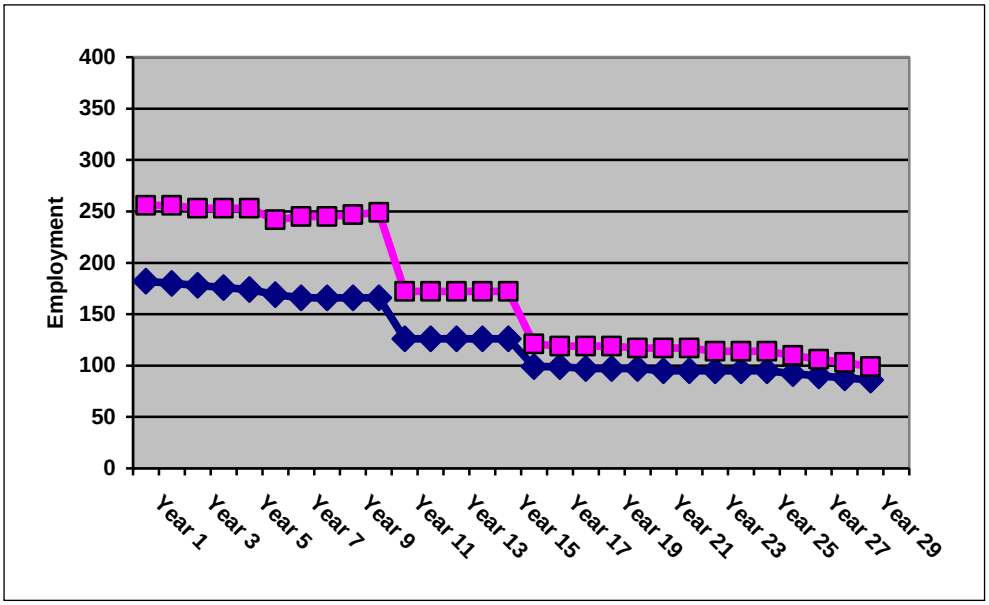
seasonal direct and secondary job effects are highest during the first 10 years of the assessment period due to the higher pace of assumed development. The number of such jobs declines over time under Alternative B as the pace of drilling drops to the point of only sustaining a single rig. Total Alternative 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

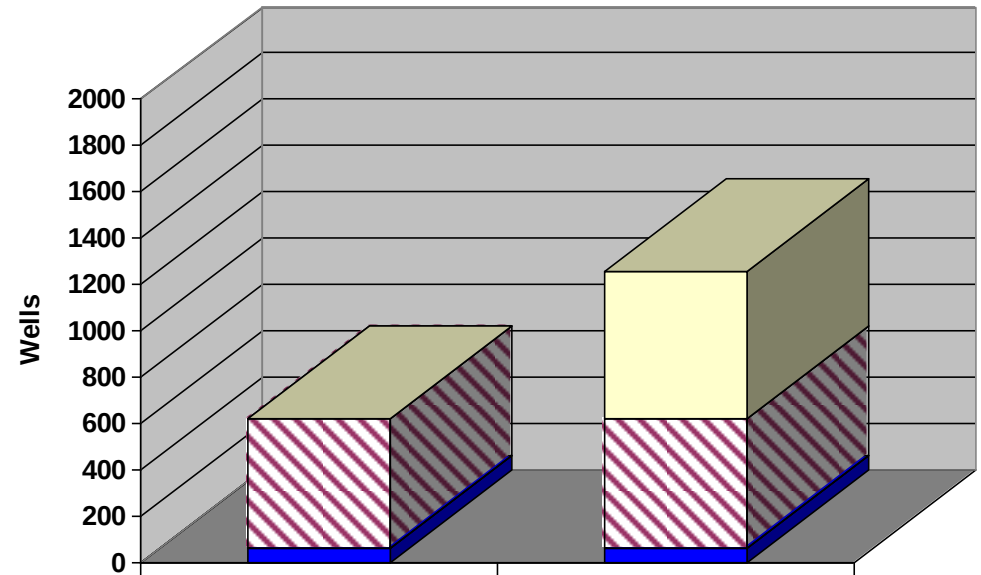
Alternative B would result in somewhat higher demand for local government services as compared to Alternative A and current levels. The increase in seasonal, temporary drilling, completion, and field-infrastructure construction crews could result in slightly increased demand for law enforcement, emergency 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

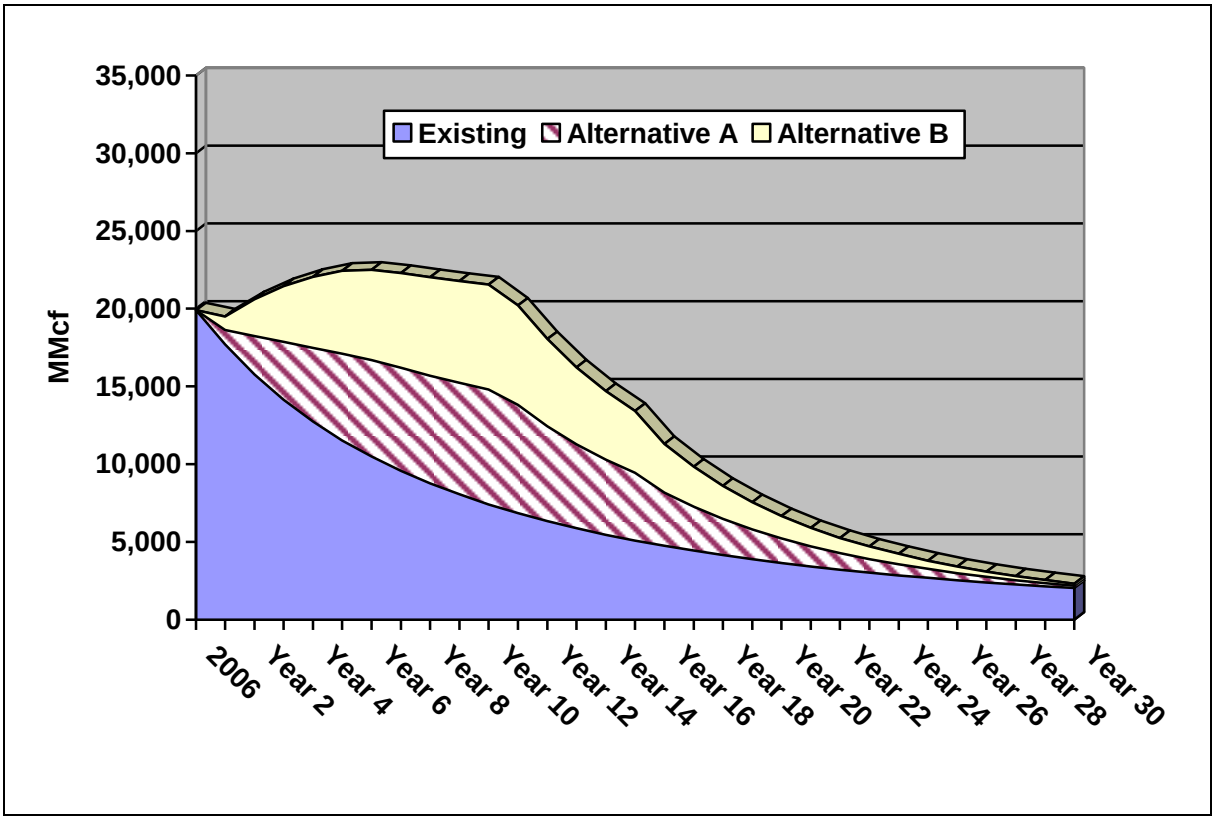


	Alternative A	Alternative B
Federal	0	635
Private	558	558
State	62	62

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

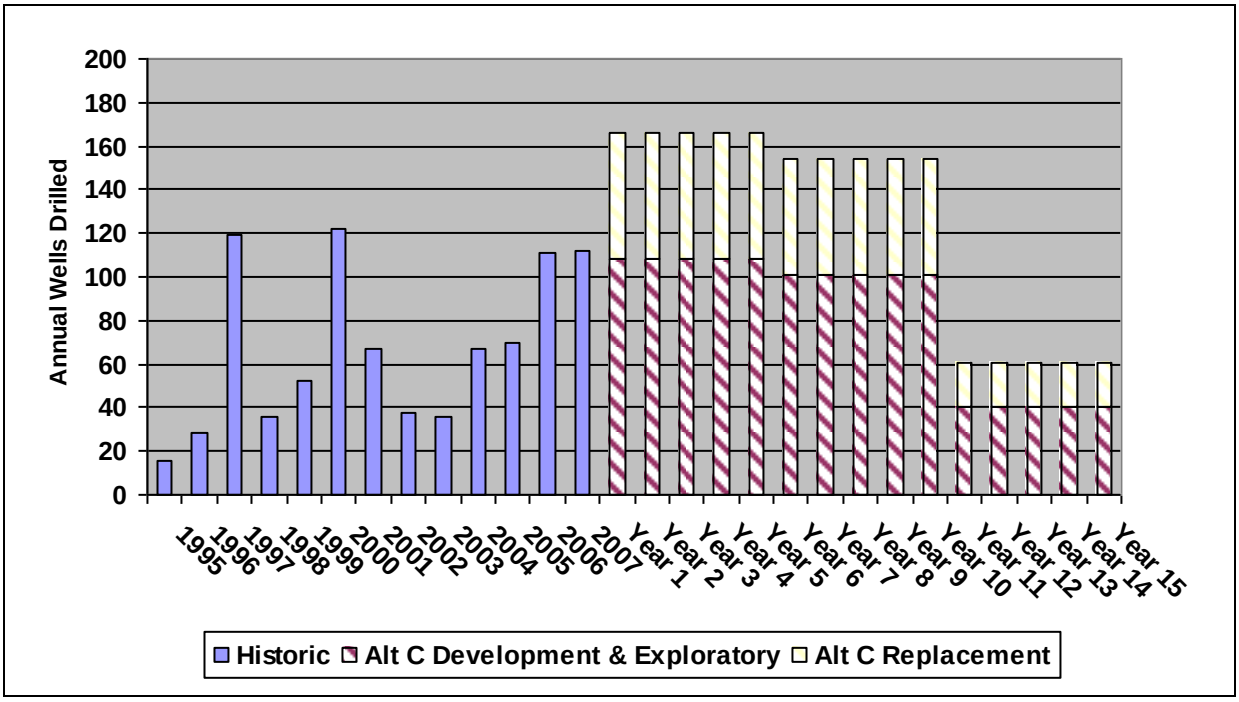
Past, present and reasonably foreseeable future actions likely to generate cumulative social and economic effects to populations within and adjacent to the BNGPA, when combined with the effects of Alternative B, are limited to natural-gas development within the area. These effects have been included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

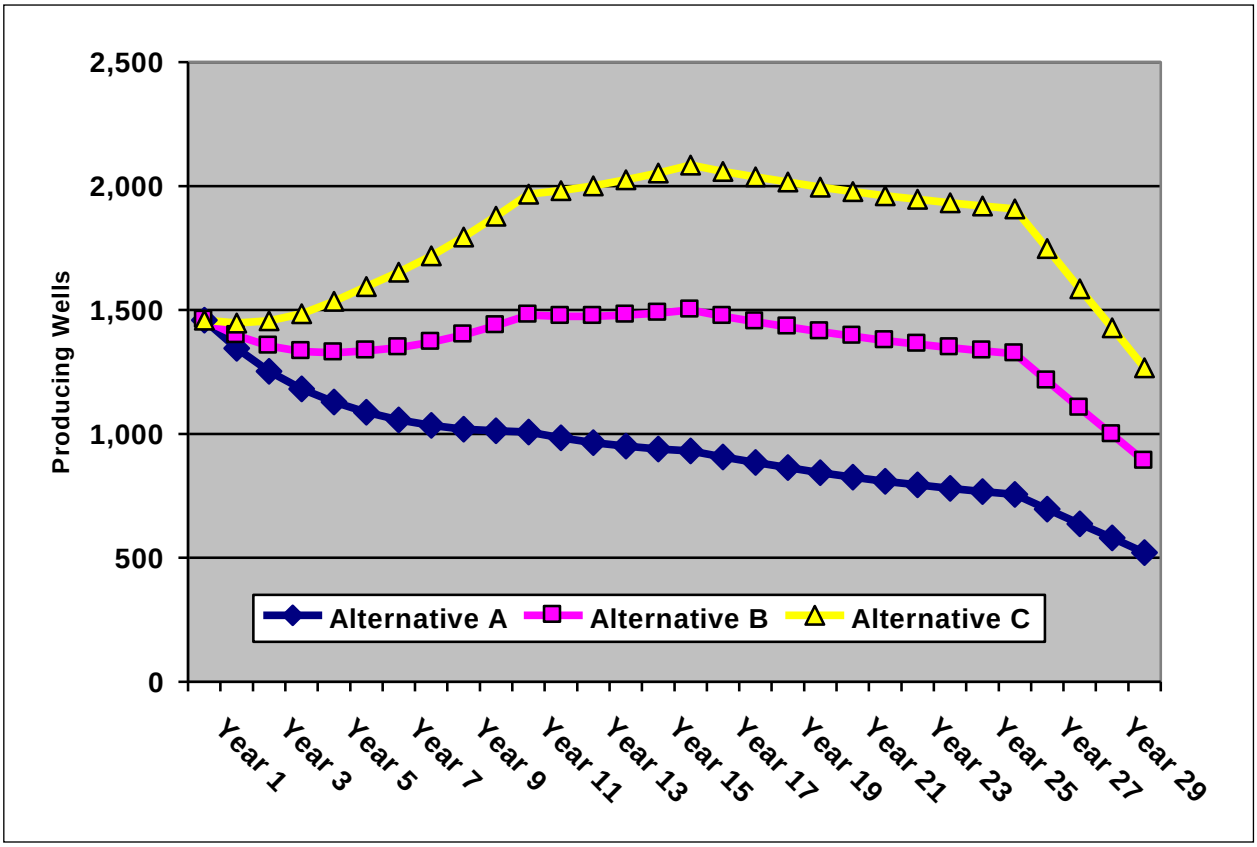
Figure 4.8-13. Historic and Alternative C Assumed Drilling Levels



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

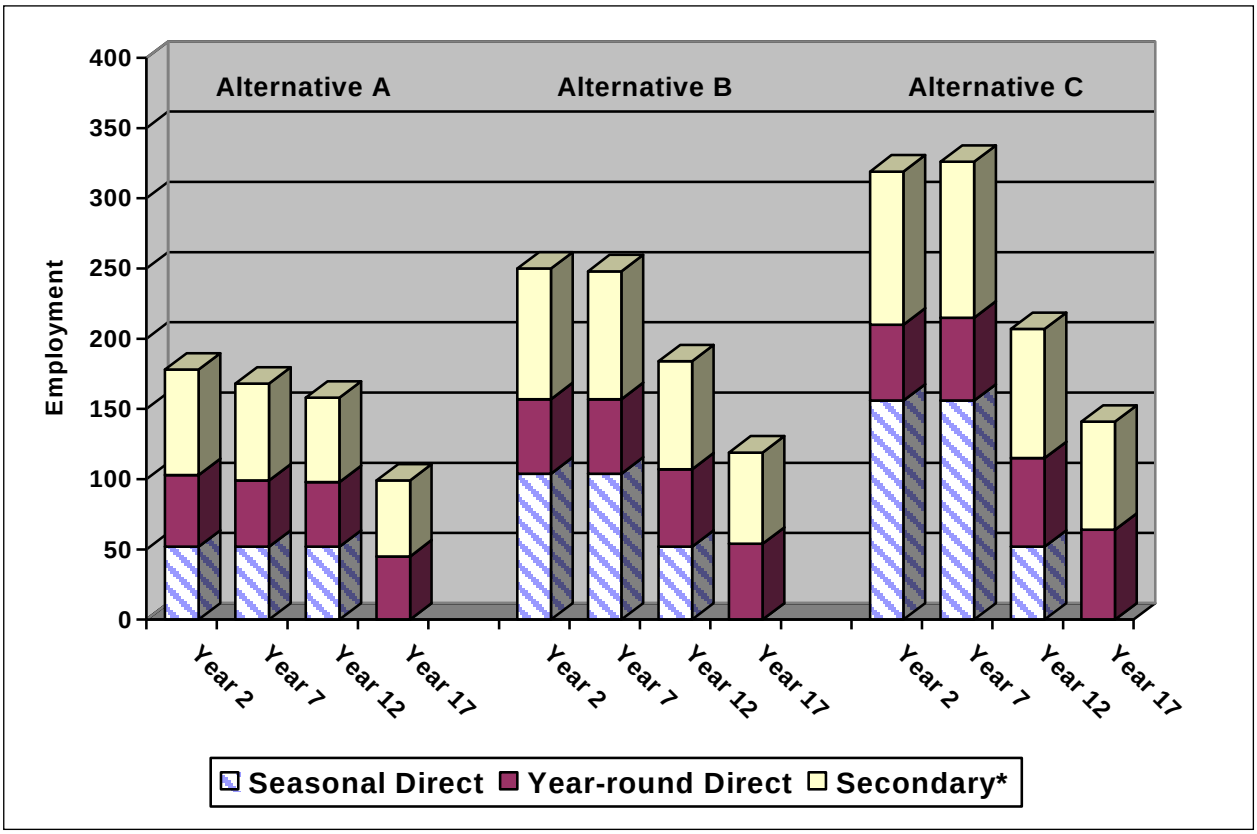


Source: Bowdoin Operators

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.

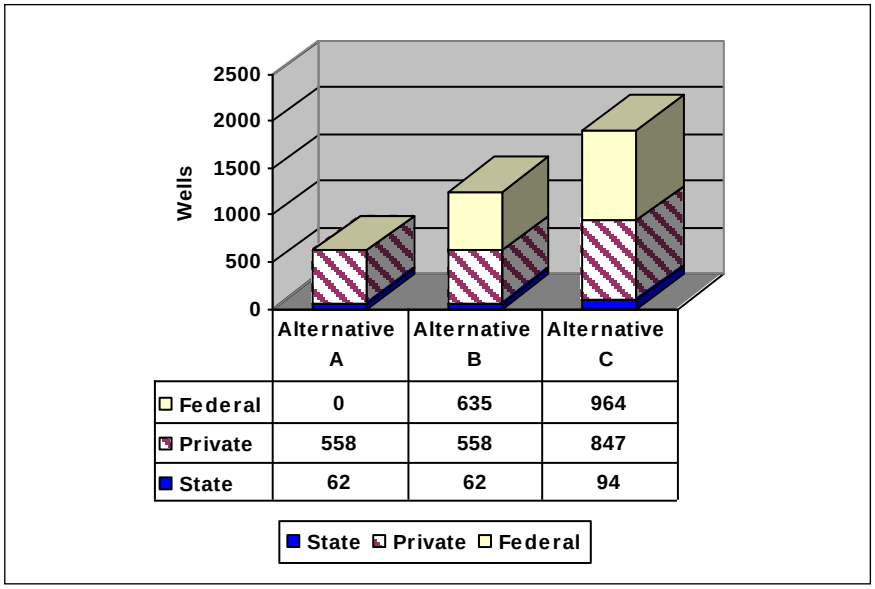
Direct and Indirect Fiscal Effects

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.

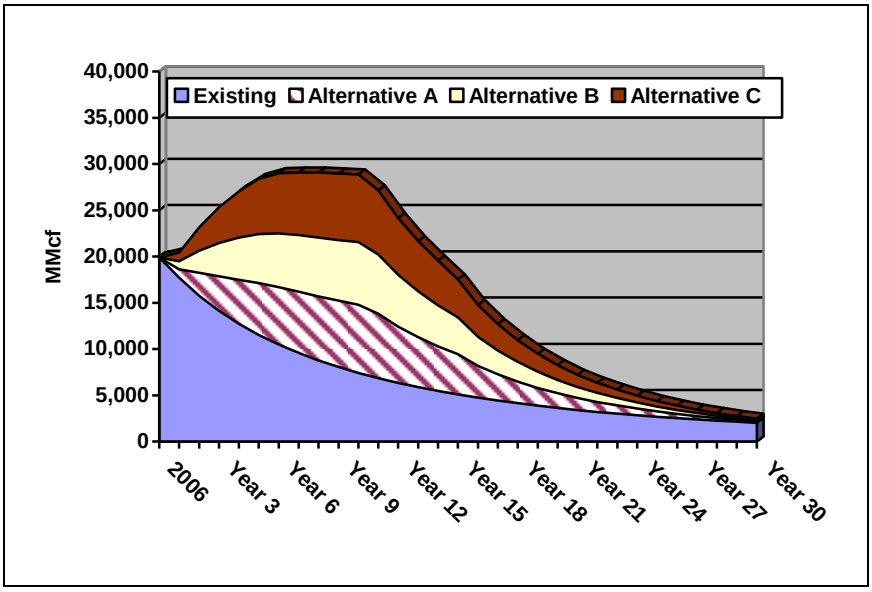
Figure 4.8-16. BNGPA Projected Wells by Mineral Ownership: All Alternatives



	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**, **Access and Transportation**, 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. Wells without artificial lift would produce increasing volumes of water as gas production declines increasing disposal trips for the estimated 25 percent of wells requiring produced-water disposal. Wells using artificial lift would produce higher volumes of water in the first year, and produce diminishing volumes of water each year thereafter requiring correspondingly fewer produced-water disposal trips each year. Overall produced-water disposal trips under Alternative A would diminish over time as existing wells cease production at higher rates than new wells are brought online.

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 and by increases in wells using artifical lift methods. 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, except for the estimated 25 percent of wells requiring produced-water disposal. Over time, reductions in BNGPA traffic associated with fewer producing wells, including fewer wells requiring produced-water disposal, 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 an average of 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, with the exception of produced-water disposal-related traffic. Trips from the estimated 25 percent of wells requiring produced-water disposal would be anticipated to increase as gas production in these aging wells decreases. Wells using artificial lift would also produce higher volumes of produced water in earlier years, diminishing each year thereafter and requiring correspondingly fewer disposal-related trips each year. Trips associated with water collection at individual well pads would be relatively infrequent; traffic on access roads leading to produced-water disposal sites would increase.

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, with the exception of produced-water disposal-related trips which would be anticipated to increase.

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 and pipeline maintenance trips, decreasing that aspect of county road maintenance demand. Water-hauling trips would lincrease as the 25 percent of wells that require produced-water disposal and the number of wells that use artificial lift would increase. This would result in higher road maintenance demands, particularly on those roads that provide access to produced-water disposal facilities.

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. As with county roads, produced-water disposal-related trips on BLM roads would increase under Alternative B.

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 an average 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, although the number of produced-water disposal trips would continue to increase as the estimated 25 percent of existing and new wells that would require produced-water disposal age and produce less gas and more water. The number of wells using artificial lift would also increase, producing more water in the earlier years, and producing lower volumes of water requiring diminishing numbers of disposal trips in subsequent years.

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. Production-related well and pipeline maintenance and water-hauling trips would also increase under Alternative C, but the volume of these trips would similarly be unlikely to affect the level of service on these highways.

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, particularly on county roads providing access to water-disposal facilities. 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. Road-kill rates are affected by species population densities, traffic volume and speed, and proximity of habitat cover and wildlife movement corridors. 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 would 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.

- Implement reduced speed limits to reduce potential for vehicle/wildlife collisions.
- No surface disturbance in big game winter range from December 1 – May 15.
- Coordinate with MFWP to formulate and implement a removal program for wildlife carcasses along roadways to avoid further mortality of raptors attracted to carcasses.

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.
- Avoid and minimize above-ground power lines in areas with sage-grouse habitat condition designated as Excellent and Sagebrush Limited, respectively.

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.
- Implement reduced speed limits 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 one mile of an active nest of listed or sensitive raptor species, and ¾ – ½ mile (depending upon species or line of sight) of an active nest of other raptor species from March 1 – August 31 (depending on species), or until fledging and dispersal of the young. The nature of the restrictions and the protection radius would vary according to the raptor species involved and would be determined by the BLM.

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. It is reasonable to consider that increases in energy development infrastructure and density could potentially cause an increase in negative 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. Nevertheless, big game populations within the BNGPA currently do not appear to be at risk. Long-term trends in big game populations (i.e., pronghorn, mule deer, and white-tailed deer) monitored within and around the BNGPA demonstrate that populations of these species have remained stable or are on the increase despite oil and gas development within the BNGPA for approximately 70 years. Mule deer and white-tailed deer numbers in the region are described as exceeding population objectives (MFWP 2008), and pronghorn populations have increased dramatically recently and are at the highest levels in the last 10 years (MFWP 2007*a*, 2008*a*). 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

Past, present, and reasonably foreseeable future actions applicable to the proposed Bowdoin Natural Gas Project would include a number of activities associated with past and present mineral exploration and development in the region in addition to historic land uses, such as livestock grazing; specifically, these include past oil and gas exploration and development by operators (Fidelity Exploration, Noble Energy, Omimex Canada, Ltd, and Decker Operating

Company) and associated reclamation, livestock grazing, road development, utility corridor placement, and some degree of increased recreational access and use (e.g., hunting).

Various roadways are present within the area. The towns of Loring and Whitewater are located in the northern portion of the Cumulative Impact Assessment Area (CIAA) and include housing- and municipality-related surface disturbance. The impacts contributed from the towns of Loring and Whitewater are unknown.

Past actions on or in the vicinity of the BNGPA include previous well exploration and development by various operators, existing water containment reservoirs, county and other ancillary access roads, livestock grazing, and a variety of operations on private land.

Under the Proposed Action, Alternative B, total short-term disturbance for drill pads, access roads, and ancillary facilities would be approximately 2,638 acres (0.324 percent of the overall project area). Construction and drilling activities are proposed for a 20-year period from the start of the project. Approximately 53 percent of the initial disturbance (e.g., 50 percent of each well pad disturbance, and 100 percent of pipelines disturbance) would be reclaimed after construction; therefore, an estimated 1,248 acres (0.154 percent of the project area) would remain disturbed in the long term. This area would be reclaimed at the conclusion of the estimated 30 to 50-year project life.

The CIAA or cumulative domains for terrestrial wildlife vary by wildlife group, based on the species' relative mobility, home ranges, and habitat use. For most species, the CIAA encompasses the project area and most of the species' home ranges. Specific to big game species and seasonal ranges, the deer CIAA encompasses MFWP Region 6 and includes Deer Herd Districts 600, 610, 611, 620, 621, 622, 630, 631, 632, 640, 650, 651, 652, 670, 680 and 690. The pronghorn CIAA also encompasses MFWP Region 6 and includes Antelope Herd Districts 600, 610, 620, 630, 640, 650, 651, 670, and 690. For most migratory birds, the CIAA includes the project area plus a one-mile buffer, and for smaller, less-mobile species (e.g., small mammal species), the area extends approximately 0.5-mile beyond the BNGPA boundary.

Past, present, and reasonably foreseeable future actions applicable to terrestrial wildlife species would include a number of activities that have occurred across the landscape within these cumulative impact domains; specifically, these include past oil and gas exploration and development, subsequent reclamation, livestock grazing, road development, utility corridor placement, and some degree of increased recreational access and use (e.g., hunting). Associated facilities would include access roads, gas pipelines, compressor stations, water disposal systems, and a power supply system.

Cumulative effects to regional terrestrial wildlife species would parallel those issues identified and discussed in **Section 4.12, Wildlife**. The past, present, and future activities combined with the proposed BNGP would incrementally contribute to overall habitat loss and fragmentation, short- and long-term animal displacement, increased vehicle mortalities, increased noise levels and human presence, and increased hunt and possible poaching.

Anticipated cumulative effects to big game species comprise one of the more important terrestrial wildlife resource issues associated with the increased oil and gas development, including the cumulative effects issues examined for the Proposed Action. Crucial winter range is most important to pronghorn and mule deer during severe storm events, years of high snowpack, or during extended and extreme winter conditions. These environmental conditions force the pronghorn into the lower elevations that historically contained suitable forage and

thermal cover necessary to support animals during periods of stress. Displacement of individual pronghorn and mule deer into adjacent areas of winter range that may or may not be characterized by plants of reduced vigor, productivity, and nutritional quality may contribute to a decline in the distribution and size of these populations.

Animals may experience severe physiological stress during the winter period—particularly gestating does that require higher levels of energy for survival and successful reproduction. Specific to mule deer, Hobbs (1989) determined that human-induced disturbances to mule deer (i.e., two disturbances per day, each disturbance causing the animals to move a minimum of 1,500 feet) during a severe winter period could double doe mortality. Mule deer in South Dakota require an average of 3.5 to 4 pounds of dry-weight daily forage per 100 pounds of body weight during the winter season (Richardson and Petersen 1974). Therefore, disturbances during the winter could prevent access to sufficient amounts of forage to sustain individual deer. A deer's ability to survive the winter and a doe's ability to produce viable offspring ultimately depend on their fat reserves, which are continuously used during the winter. Increased stress that causes these fat reserves to be used faster reduces survival for deer, as well as for interuterine fawns. Therefore, increased human activity or harassment combined with a severe winter event could lower both deer survival rates (Richardson 1992; Yarmoloy et al. 1988) and doe fecundity. These factors would apply to the pronghorn and the mule deer winter ranges located within the CIAA.

The established pronghorn CIAA encompasses 17,909,509 acres in MFWP Region 6. Available pronghorn winter range within this CIAA encompasses an estimated 4,095,150 acres, including 150,831 acres within the BNGPA. In the long term, the Proposed Action could affect approximately 3.7 percent of total pronghorn winter range within the CIAA. This assumes that well density, human presence, and ancillary facilities would affect all pronghorn winter range within the BNGPA, and likely displace animals along the edges of this winter range during the life of the project. Competition between pronghorn displaced from the BNGPA and pronghorn in adjacent areas potentially would increase, creating additional localized impacts in winter range bordering the BNGPA. An estimate of past and present surface disturbances within this same CIAA has not been calculated.

Under the Proposed Action, Alternative B, well density is projected to be four wells per one-mile-square section and cumulative disturbances of up to 8.4 acres per one-square-mile (640-acre) section. Assuming full-field development (1,255 wells) over a 10- to 15-year period, the total short-term disturbance for drill pads, access roads, and ancillary facilities would be approximately 2,638 acres (0.324 percent of the overall project area). Approximately 53 percent of the initial site disturbance would be reclaimed after construction; therefore, an estimated 1,236 acres (0.154 percent of the project area) would remain disturbed in the long term. This area would be reclaimed at the conclusion of the estimated 30 to 50-year project life.

Existing access roads in the vicinity of the BNGPA increasingly fragment native habitats. Although the effects of this fragmentation are not quantified, roads can disrupt large mammal populations, even if they do not present a physical barrier (Andrews 1990; Richardson 1992), as typically exhibited in more open grassland and scattered shrubland habitats. As an example, roads resulting from energy development in the Book Cliffs of Utah were shown to result in a greater impact to mule deer than the direct habitat loss (Karpowitz 1984). The cumulative development of regional access roads could continue to increase overall habitat fragmentation and animal displacement, both from the presence of the roads and from a change to the vegetation composition in proximity to the road margins. This change to vegetation would be caused by a change in soil temperature, level of dust accumulation, and moisture content

(Vaillancourt 1995). Based on applicable resource studies, the plant community composition would likely be altered within 165 to 200 feet from the road edge (Gelhard and Belnap 2003; Baker and Dillon 2000).

Combining the degree of specific habitat loss, fragmentation, human activity, and increased noise from past and present activities, including the Proposed Action, the cumulative impacts to big game species would reduce the amount of and access to crucial winter range available for these species. As the densities of wells, roads, pipeline rights-of-way, compressor stations, and other facilities continue to increase and expand, habitat is not only lost in these specific areas, but the effectiveness of the adjacent habitats (i.e., zone of influence) also may decrease. Displacement of individuals forces animals into marginal habitats or requires them to compete with animals already occupying adjacent areas. Increased displacement and inter- and intra-species competition ultimately may lower survival rates during the winter and decrease reproductive success, population numbers, and the range's carrying-capacity. In summary, the effects of the Proposed Action would incrementally add to the cumulative effects on big game species in this area. The limited amount of crucial winter range for both pronghorn and mule deer cumulatively affected within the established CIAA would aid in keeping these effects more isolated. It is possible that the project might have a minimal effect on the abundance and/or distribution of some wildlife species at the scale proposed; however, significant impacts are not expected due to abundant suitable habitat throughout the BNGPA.

No potential water quality or water quantity effects were identified for terrestrial wildlife species for the proposed Bowdoin Natural Gas Project. Not all wildlife can be excluded from reserve pits; consequently, some cumulative impacts to wildlife may occur through their inadvertent access to pits during project operation.

Cumulative issues for other wildlife groups (e.g., waterfowl, water birds, raptors, passerines small- and medium-sized mammals, reptiles) would parallel the overall anticipated habitat loss, fragmentation, some direct mortality (e.g., vehicle collisions, interred burrowing animals), and animal displacement in the short and long term. As discussed in **Section 4.12, Wildlife**, the BLM has developed applicable mitigation measures and successful applicants for past, present and reasonably foreseeable projects have committed, and would be required to commit, to specific protection measures to minimize these effects.

Residual cumulative effects after these measures are applied would encompass a further incremental reduction in the amount of available cover, foraging opportunities, and breeding areas for a variety of small and large species throughout the food chain in both the short and long term. Additional development potentially could preclude animals from using areas of more intensive human activity. However, the severity of the cumulative effects generally would depend on factors such as species sensitivity, seasonal intensity of use, type and duration of project activities, and physical parameters (e.g., topography, forage, thermal cover, slope, aspect).

Residual cumulative impacts from habitat loss and fragmentation would be important to certain bird species, such as neotropical migrants (e.g., Swainson's hawk, songbird species) that currently are experiencing additional population pressures from external factors unrelated to mineral development outside of the project area. A combination of local, regional, and international issues is impacting these overall populations; however, the anticipated cumulative effects would once again be considered to be isolated, incremental impacts to overall habitat availability for these species.

In summary, the overall cumulative effects identified within the CIAAs delineated for terrestrial wildlife species would continue to contribute incremental direct, indirect, short-term, and long-term impacts to both resident and migratory species. Both protection and mitigation measures developed for the resource area and cumulative components would aid in minimizing impacts. However, residual impacts would remain that encompass overall habitat loss and fragmentation, some direct mortality, and some animal displacement, depending on a number of factors including species sensitivity, habitat availability, buffering factors, existing prey base, and type of project-related activities. 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.

4.12.3 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.

Impacts to piping plovers and least terns would be minimized by implementing the following BLM mitigation measures:

- The FWS, in cooperation with the Bureau of Reclamation, conducts annual piping plover and least tern surveys on shorelines of Hewitt Lake NWR and Nelson Reservoir. BLM will be a partner in these surveys as needed when planned developments might impact plover and tern habitat.
- Potential piping plover nesting habitat near drilling and construction sites at Nelson Reservoir and Whitewater Lake will be identified and appropriate surveys will be conducted for this species prior to oil and gas activities. A timing stipulation during the nesting season would protect nesting piping plovers, but would not protect the function and utility of the site for subsequent nesting activity or occupancy. Therefore, a NSO stipulation will apply to all new developments as well as to modifications of existing developments within ¼ mile of piping plover nest sites, piping plover nesting habitat, and designated Critical Habitat (Critical Habitat is on Bowdoin NWR). This stipulation will minimize threats and disturbances to piping plovers, and prevent fragmentation and degradation of piping plover nesting habitat and Critical Habitat. Waivers, exceptions, and modifications may apply if it is determined that the factors leading to its inclusion have changed sufficiently to make the protection provided by the stipulation no longer justified, so long as the proposed operations would have “No Effect” on piping plovers and would not “Adversely Modify” piping plover Critical Habitat. Should least terns be found to nest at either location, the same ¼-mile NSO stipulation would apply to least tern habitat.
- The USFWS is particularly concerned about selenium concentrations greater than 2 ug/L, sodium concentrations over 17,000 mg/L and the presence of BTEX hydrocarbons (benzene, toluene, ethylbenzene and xzylene) in production pits. The USFWS is also concerned that concentrations of trace elements and salts in pits could increase through evaporative concentration and create a hazard for migratory aquatic birds such as the piping plover and least tern. Onshore Oil and Gas Order No. 7 (43 CFR 3160) ensures that a water analysis of toxic constituents that are reasonably believed to be present in production wells, are conducted prior to approval of lined and unlined pits (i.e., pH, hardness, sodium, magnesium, calcium, iron, chloride, bicarbonate, sulfate, carbonate and nitrate). Historically, water-quality testing has shown no problems and there have been no records of birds being trapped or found dead in oil or gas well disposal pits in the BNGPA. To determine if other toxic constituents are present or if, over time, concentrations of trace elements and salts increase to levels toxic to birds, BLM will test and analyze existing production pit wastewater within ¼ mile of existing piping plover habitat. A ¼-mile NSO stipulation will apply on all new developments within a ¼ mile of piping plover or least tern habitat and Critical Habitat. If at that time, water in gas well production pits is determined to be hazardous to birds, mitigation measures to exclude piping plovers and least terns from pits with toxic waters will be applied.
- Because gravel roads and well pads may attract piping plovers during the nesting season, BLM will apply COAs and ROW stipulations that prohibit the development of ‘graveled’ roads or well pads for oil and gas operations within ¼ mile of piping plover habitat. Additional COAs under which an APD or Sundry Notice is approved may be required on a case-by-case basis for new or existing leases. Application of the “200 meter/60-day rule” (allowable under standard lease terms) may be required to approve an APD or Sundry

Notice, to protect areas temporarily used by piping plovers or least terns for activities other than nesting.

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. Eight 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 could potentially result in the direct loss of 96 acres of excellent habitat initially, and 46 acres for the life of the project. In addition, impacts to Greater sage-grouse due to West Nile virus would be minimized by implementing the following BLM mitigation measures:

- Overbuild the size of ponds to accommodate a greater volume of water than is discharged. This will result in non-vegetated and muddy shorelines that breeding mosquitoes avoid.
- Build steep shorelines to reduce shallow water and aquatic vegetation around the perimeter of impoundments. Construction of steep shorelines also will increase wave action that deters mosquito production.
- Maintain the water level below rooted vegetation for a muddy shoreline that is unfavorable habitat for mosquito larvae. Rooted vegetation includes both aquatic and upland vegetative types. Always avoid flooding terrestrial vegetation in flat terrain or low-lying areas.
- Use a horizontal pipe to discharge inflow directly into existing open water, thus precluding shallow surface inflow and accumulation of sediment that promotes aquatic vegetation.
- Fence pond site to restrict access by livestock and other wild ungulates that trample and disturb shorelines, enrich sediments with manure, and create hoof-print pockets of water that are attractive to breeding mosquitoes.
- Use adulticides to target adult mosquito populations and larvicides to control the hatching of mosquito larvae, using approved pesticides and utilizing licensed applicators with a Pesticide Use Plan.

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. It is possible that the project might have a minimal effect on the abundance and/or distribution of sensitive species at the scale proposed; however, significant impacts are not expected due to abundant suitable habitat throughout the BNGPA. 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. Properly implemented BLM and resource-specific mitigation measures should reduce impacts associated with the development phase of the project when the effects to wildlife populations would be greatest. Once the proposed action enters the production phase. human activity decreases, and reclamation restores habitat, wildlife populations negatively affected by the initial development phase should increase and displaced animals should return to suitable habitat areas. 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. Loss of Greater sage-

grouse nesting and brood-rearing habitat from construction activities under Alternative B could might result in the direct loss of 193 acres of excellent habitat initially, and 91 acres for the life of the project.

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. Loss of Greater sage-grouse nesting and brood-rearing habitat from construction activities under Alternative C could potentially result in the direct loss of 292 acres of excellent habitat initially, and 138 acres for the life of the project.

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.

Cumulative Impacts

Alternative A would result in an increased risk to public and worker safety in the project area. The majority of this increased risk would be related to the increased level of development activity occurring on private land. The potential for increased recreational use of private land portions of the project area would enhance potential conflict, increase traffic-related hazards and increase public exposure to development and production operations. Background levels of interface between the recreating public, agricultural operations, and existing gas production operations would continue.

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:

- Implement 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
- Consider installing centrally located produced-water disposal facilities and a produced-water gathering system

Cumulative Impacts

Alternative B impacts would result in an increased level of threat to public and worker safety in the project area when compared to Alternative A. This increased risk would be related to the increased level of development activity occurring in the project area on both private and BLM-managed lands. The potential for increased recreational use in the project area would enhance potential conflict, increase traffic-related hazards, and increase public exposure to development and production operations. Background levels of interface between the recreating public, agricultural operations, and existing gas production operations would continue.

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

Alternative C would result in the greatest potential for increased traffic and interpersonal conflict within the operating areas of the BNGPA, similar to those discussed for the other alternatives analyzed. These 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 generate noise at the 70 to 80 dBA level at one meter unless hospital-style mufflers are installed. The installation of these mufflers would reduce the noise generated by an individual pump jack to 35-40 dBA at 7–10 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 4.15-1. 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.

Cumulative Impacts

Alternative A would result in an increased level of noise as new and existing wells are placed on artificial lift systems and additional compression is put online throughout the gas-gathering system. The majority of this increase in noise would come from development taking place on private lands. There are no other known planned or reasonably foreseeable developments within the project area that would further increase area 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 wind.

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.

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.

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.

Cumulative Impacts

Alternative B would result in increased noise levels across the project area as new and existing wells are placed on artificial lift systems and additional compression is put online throughout the gas-gathering system, when compared to Alternative A. There are no other known planned or reasonably foreseeable developments within the project area that would further increase area 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.

4.15.3 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

Alternative C would result in the greatest across-project-area increase in noise as new and existing wells are placed on artificial lift systems and additional compression is put online throughout the gas-gathering system. There are no other known planned or reasonably foreseeable developments within the project area that would further increase area 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.

5. CONSULTATION AND COORDINATION

5.0 INTRODUCTION

An environmental assessment (EA) must be prepared when a federal government agency considers approving an action within its jurisdiction that may impact the human environment. An EA aids federal officials in making decisions by presenting information on the physical, biological, and social environment of a proposed project and its alternatives. The first step in preparing an EA is to determine the scope of the project, the range of action alternatives, and the impacts to be included in the document.

The Council on Environmental Quality (CEQ) regulations (40 CFR, Parts 1500-1508) require an early scoping process to determine the issues related to the Proposed Action and alternatives that the EA should address. The purpose of the scoping process is to identify important issues, concerns, and potential impacts that require analysis in the EA and to eliminate insignificant issues and alternatives from detailed analysis.

The Bowdoin Natural Gas Project EA was prepared by a third-party contractor working under the direction of and in cooperation with the lead agency for the project, which is the Bureau of Land Management (BLM), Great Falls Field Station, Great Falls, Montana.

5.1 PUBLIC PARTICIPATION

A Scoping Notice was prepared and submitted to the public by the BLM on March 27, 2006, requesting input to the proposed Bowdoin Natural Gas Field Development project. Scoping documents were sent out to the public listed on the BLM mailing list, as well as organizations, groups, and individuals requesting a copy of the scoping document. Eight written responses were received during the scoping period in response to this project. The issues and concerns identified by the public during the scoping period are summarized in **Section 1, Purpose and Need**.

During preparation of the EA, the BLM and the consultant interdisciplinary team (IDT) have communicated with, and received or solicited input from various federal, state, county, and local agencies, elected representatives, environmental and citizens groups, industries, and individuals potentially concerned with issues regarding the proposed drilling action. The contacts made are summarized in the following sections.

The following organizations/individuals either provided comments or were provided the opportunity to comment during the scoping period.

FEDERAL OFFICES

Bureau of Indian Affairs
Office of the Governor
U.S. Bureau of Reclamation
U.S. Department of the Army, Corps of Engineers
U.S.D.I. Bureau of Land Management

- Montana State Office
- Havre and Glasgow Field Stations and Lewistown and Malta Field Offices
- Great Falls Field Station

U.S. Fish and Wildlife Service

STATE AGENCIES AND OFFICES

Montana Board of Oil and Gas Conservation
Montana Department of Environmental Quality (Land, Water, and Air)
Montana Department of Natural Resources and Conservation
Montana Department of Transportation
Montana Fish, Wildlife, and Parks
Montana State Historic Preservation Office
Montana State Representatives
U.S. Representative Dennis Rehberg
U.S. Senators Max Baucus and Jon Tester
Former U.S. Senator Conrad Burns

COUNTY GOVERNMENT

Phillips and Valley County Commissioners
Phillips and Valley County Libraries

MUNICIPALITIES

Mayors of Malta, Glasgow
Chambers of Commerce for Malta, Glasgow

NATIVE AMERICAN TRIBES

Blackfeet Nation
Chippewa Cree Tribe
Crow Tribal Council
Fort Belknap Assiniboine and Gros Ventre Tribes
Fort Peck Assiniboine and Sioux Tribes
Little Shell Tribe of Chippewa Indians of Montana
Turtle Mountain Band of Chippewa Indians

GRAZING PERMITTEES

Grazing Permittees within the project boundary

LEASE AND RIGHT-OF-WAY HOLDERS

Affected oil and gas lessees
Affected right-of-way holders

LAND OWNERS

LOCAL MEDIA

- Newspapers
  Associated Press
  Fort Benton River Press
  Glasgow Courier
  Great Falls Tribune
  Havre Daily News
  Lewistown News Argus
  Phillips County News
- Radio Stations
  KLTZ – Glasgow
  KMMR – Malta
  KOJM – Havre
  NPR – Helena
- Television Stations
  KFBB – Great Falls
  KRTV – Great Falls

OTHER AGENCIES, INDUSTRY REPRENSENTATIVES, INDIVIDUALS, AND ORGANIZATIONS

Audubon Society
Central Montana RAC
Earth Justice
Independent Petroleum Association of Mountain States
Legal Defense Fund
Montanans for Multiple Use
Montana Petroleum Association
Montana States Legal Foundation
Montana Wildlife Federation
Montana Wilderness Association
National Wildlife Federation
Rocky Mountain Mineral Law Foundation
Sierra Club
The Wilderness Society

5.2 LIST OF PREPARERS

The following tables identify the BLM Interdisciplinary Team (IDT) (Table 5-1) and the consultant IDT (Table 5-2) that were principally involved with preparing this EA.

Table 5-1. List of BLM Interdisciplinary Reviewers

BLM INTERDISCIPLINARY TEAM	
Name	**Responsibility**
Don Judice	Team Leader/NEPA Coordinator
Jerry Clark	Cultural Heritage
Jon Collins	Transportation/Access VRM/OHV/Recreation
Jennie Jennings	Water Resources
Jon Kautt	Noxious Weeds
Amanda Keefer	GIS Technical Specialist
Candace Meyer	Realty/Rights-of-Way
Jody Miller	Ethnography
Dwain M. “Fritz” Prellwitz	Wildlife/Fisheries, Special Status Species
B.J. Rhodes	Rangeland Health
Josh Sorlie	Soils
John Thompson	Economy
Joan Trent	Sociology
Barney Whiteman	Fluid Minerals

Table 5-2. List of Consultant Interdisciplinary Team EA Preparers

PRINCIPAL INTERDISCIPLINARY TEAM		
Name	**Affiliation**	**Responsibility**
Gary Holsan	Gary Holsan Environmental Planning	Interdisciplinary Team Leader, Project Manager
Larry Bennett	Hayden-Wing Associates	Vegetation and Wetlands, Special Status Plants
George Blankenship	Blankenship Consulting	Socioeconomics, Transportation, Health & Safety, Noise
Dina Brown	KC Harvey, Inc.	Soils, Reclamation
Charles Bucans	Star Valley Engineering, Inc.	Proposed Action/Coordination
Susan Connell Jim Zapert	Sage Environmental Consulting	Air Quality
Mike Evers Ken Collier	WWC Engineering	Water Resources
Larry Hayden-Wing	Hayden-Wing Associates	Wildlife/Fisheries, Special Status Animals and Fish
Lloyd Levy	Lloyd Levy Consulting	Visual Resources and Recreation
Ben Parkhurst	Hayden-Wing Associates	Fisheries Biologist
Lynelle Peterson	Ethnoscience, Inc.	Cultural/Historical Resources
Renee Taylor	Taylor Environmental Consulting	Hazardous Materials, Health and Safety, Noise
Gustav Winterfeld	Erathem-Vanir Geological Consultants	Geology, Paleontology, Mineral Resources
Technical Support Team		
Connie Hedley	Hayden-Wing Associates	Document Editing and Production
Linda Schuemaker	Otak, Inc.	Final Document Editing and Production
Jason Sutter	Hayden-Wing Associates	Wildlife Biologist, GIS
Jeff Winstead	Hayden-Wing Associates	Cartographer, Wildlife Biologist

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APPENDIX A

Master Application for Permit to Drill

FIELDWIDE DRILLING OPERATIONS PLAN FOR DRILLING AND SURFACE USE FOR ALL FIELDS/UNITS/LEASES (FEDERAL) IN PHILLIPS COUNTY AND ALL FIELDS/UNITS/LEASES (FEDERAL) WEST OF HINSDALE IN VALLEY COUNTY

March 21, 2005

All drilling and surface operations in the above listed natural gas fields will comply with the intent of 43 CFR 3101.1-2; 3101.1-3; 3160, Onshore Oil and Gas Orders (OOGO) No. l, No. 2, No. 6 and No. 7, Notice to Lessees (NTLs) 3-A and 4A, NTL-MSO-1-85 and the BLM-USFS brochure, "Surface Operating Standards for Oil and Gas Exploration and Development" (the gold book). A copy of this book is available at GFFS.

A copy of this plan, the particular Application for Permit to Drill (APD) and APD attachments shall be on the well location and available for reference during the construction and drilling phase. The APD attachments that will be required for approval and required to be at the well site during drilling operations are the following:

1) Survey Plat of the well;

2) A cut and fill diagram of the well pad including rig orientation per Exhibits 3 or 4;

3) A topo map (7½ minute map) which displays the pipeline route, water source, access road, mud disposal and well location;

4) The specific areas as addressed within the Drilling Operations Plan; Items 1, 4, 5 and 7 and

5) The APD Form (3160-3) with the self certification statement as outlined in OO#1 Section III.G.4.(b).(13).

6) The specific Conditions of Approval, if needed, which are attached to the APD.

In addition, in Item #23 of this Form, the Operator can outline any deviations to this Surface Use Plan of Operations, which may need additional approval.

The overriding NEPA document for the above areas is titled, "Environmental Assessment for Bowdoin Area Increased Density Drilling - 1989" (Bowdoin EA). ***This EA establishes a level of drilling wells at a spacing of 4 wells/section. Currently the cumulative effects analysis for the 4 Units (Loring, Whitewater, Ashfield and Bowdoin) and the 4 Fields (East Loring, West Loring, East Whitewater and Swanson Creek) is still valid.*** The EA did not analyze either the Martin Lake or Milk River Units which were formed in late 1998.

DRILLING OPERATIONS PLANS - This plan will apply only to those wells drilled in the areas specified above and for proposed wells to be drilled and completed 400 ft deeper than the top of the Phillips/Greenhorn formation (i.e., TD no deeper than 2500 ft).

1. Estimated Tops of Important Geologic Markers

It will be required under this plan to disclose the top of the following geologic markers on the APD Form 3160-3 and whether oil, gas or water will be present within the following formations:

Claggett, Eagle, Niobrara, Carlile (Bowdoin) and Greenhorn (Phillips)

2. Pressure Control Equipment

BOPE and CHOKE MANIFOLD The pressure control equipment to be used under this plan will be consistent with a 2M system under OOGO No. 2. Particularly, at a minimum the BOP equipment shall be comparable with the 6" 900 Series 2,000 PSI Regan "Torus" BOP (annular BOP). The choke manifold will be a 2" steel line system and be rated to 2000 PSI, including all valves, chokes and fittings (See Exhibits No. 1 and 2; BOP and Choke Manifold Diagrams.). Blowout preventer controls will be installed prior to drilling the surface casing plug ***and will remain in use until the well's mechanical integrity is secure and the drilling unit has left the location.***

ACCUMULATOR SYSTEM Under this plan, rather than using the required accumulator system, wells will be allowed to be drilled using the rigs' hydraulic pumps and a hand/foot hydraulic pump as backup to activate the annular preventer. Per a field test and review of the described, this system was deemed to be acceptable to the Great Falls Resource Area following a demonstration showing that the rig pumps or the backup hand/foot pump could affectively close the annular BOP within an acceptable time given the fields' downhole pressure conditions.

PRESSURE TESTING and Operation of BOP EQUIPMENT Under this plan, the annular preventer and related well control equipment will be tested in accordance with the requirements of OOGO No. 2.III.A.2.i. Specifically, to mention a few of the requirements but not limited to these requirements: the annular preventer shall be tested to ***600 psi***. If a test plug is utilized, the test shall be performed for a minimum of 10 minutes and no bleed off pressure is acceptable. For a test not utilizing a test plug (testing against the casing), the test shall be performed for a minimum of 30 minutes. Should the pressures decline more than 10% in thirty minutes, the test shall be considered to have failed and the equipment will need to be retested until the test requirements are met.

Pressure tests of BOP equipment that may be subject to pressure shall be conducted before drilling the surface casing shoe, when initially installed, whenever any seal subject to test pressure is broken, following related repairs and at 30-day intervals. Annular preventers shall be inspected and operated weekly to ensure good mechanical working order. These inspections shall be recorded on the daily drilling report.

3. Casing and Cement Program Casing under this plan shall meet the following requirements:

Surface Casing — A minimum of 150 feet or 10 percent of the projected total depth of the well, whichever is greater, of 7-inch, 17#/ft API-graded H-40 casing would be set. New limited-service pipe may be used for the surface casing but would require prior approval by the BLM prior to being installed in a federal well. The surface casing will be set utilizing a minimum of 65 sacks of Class "G" cement with reasonable necessary additives (this allows for 70% excess over the

calculated annular volume). The surface casing shall be cemented back to surface either during the primary cement job or by remedial cementing. Five bbls of fresh-water flush shall be used ahead of cement when cementing surface casing. At a minimum a top wiper plug shall be used while displacing cement into place and shall be displaced no closer than 30 ft from above the shoe. Surface casing shall have a centralizer on each of the bottom three joints.

Production Casing — At a minimum production casing will be consistent with 4½", 9.5#/ft, J-55 casing. The production casing will be set utilizing a minimum of 11.5 sacks/100 ft of hole of class "G" cement with reasonable necessary additives (this allows for 25% excess over the calculated annular volume at a cement yield of 1.15 ft3/sack). Higher yield cement (i.e., 50-50 Poz) is allowed under this plan provided the cement will reach a compressive strength of 1500 psi.

The production casing shall be cemented back to surface either by primary cementing or by remedial cementing. A best attempt shall be made to assure that all productive intervals are isolated with good cement coverage around the pipe. This shall be accomplished by placing centralizers at 100 feet above and below the productive interval and placing the centralizer every 100 ft between the top and bottom centralizer. Ten bbls of fresh-water flush shall be used ahead of cement when cementing production casing.

4. **Mud Program** Under this plan, the mud program shall comply with applicable requirements of OOGO No. 2.III.C. ***It will be required under this plan to disclose the specific mud system to be used prior to approval of the APD (i.e., a mud system with Alcomer 120L-Os Polymer or E-Z Mud Polymer).***

Weighting materials and loss circulation materials will be on location if pressures require or in the event of loss circulation. Visual monitoring of the mud pits is acceptable.

No trivalent or hexavalent chromate additives shall be used in the mud system. Due to potential for contamination of usable quality water aquifers, chromates are banned from Federal leases. An example disclosure of the mud system would be something similar to the following table:

Depth	Type	Wt. #/gal	Vis. sec./qt.	Fluid loss
0-150	Native muds	8.5-9.0	30-40	--
150-TD	Low fluid-loss mud system	9.5	45	n/c

5. **Evaluation Program** Drill stem testing and coring will not be required under this plan, however should it be desired to conduct DST operations, they shall be conducted in accordance with the requirements of OOGO No. 2.III.D. Drilling Stem Testing Requirements. Coring operations are allowed in conjunction with normal drilling operations, however the results of the coring operations will be required to be submitted with the completion report.

At a minimum but not limited to, the logging program shall consist of tools that will allow for geologic correlation between the wells ***in either cased or open hole logging applications*** (i.e., Gamma Ray/Compensated Neutron-Density log, ***Gamma Ray/TDT***

log, or an SP/Resistivity log from total depth to the base of the surface casing). The results of the logging operations shall be submitted with the completion report.

6. **Anticipated Abnormal Pressures, Temperatures or Other Hazards** Based on empirical data of the described area, no abnormal pressures or temperatures have been noticed or reported in wells drilled, nor within the proposed zones of interest identified above. Bottom hole pressure expected is 400 PSI. No hydrogen sulfide or other hazardous fluids or gasses have been found, reported, or know to exist at these depths in the area of interest.

7. **Drilling Activities** The anticipated starting date is set for as soon as possible after examination and approval of the APD. Operations should be completed within five days after spudding the well to casing point.

   Operator shall disclose those activities on an attachment to the APD varying from Drilling Operations Plan Items 2, 3 and 6 for the approval of the Authorized Officer. This may include but not be limited to changes in casing sizes, changes in the BOP equipment, or fundamental changes in how the well is to be drilled (conventional drilling techniques versus coiled tubing techniques).

SURFACE OPERATIONS

1. EXISTING ROADS

For the area(s) covered by the Transportation Plan (Ashfield, Whitewater and Loring Units; East Loring, West Loring, East Whitewater and Vandalia Fields), between the BLM and Noble Energy Inc, the Plan will be the governing document for road and access issues. If an Operator needs to access his lease/well and must travel through the fields/units which are under the Transportation Plan, the Operator must notify Noble Energy Inc. of the activity and understand that the stipulations and mitigation measures contained in the Plan apply to his access. For all areas outside of this Plan, this fieldwide guide will be the governing document for road and access issues.

Existing lease roads will be maintained, bladed and graveled, as necessary, to keep them in a good usable condition for safe vehicular traffic and free of surface erosion and excessive ruts. Culverts, ditches, water turnouts and other features, if necessary, will be fully functional and maintained. All lease roads which travel through private surface or state surface will have the concurrence of the private land-owner before any road work is undertaken. Any exceptions must be approved by the GFFS.

When safety, excessive rutting or erosional problems are discovered on existing roads, they will be repaired, by the primary Operator who uses the road, to assure safety and stability and to limit erosion. The new road standards described below will be followed where practical and effective under the working conditions at hand. Snow will be plowed only when necessary to keep roads open for orderly operation of the field. Roads and trails no longer needed for oil/gas operations will be closed to vehicular traffic and may, if necessary, need to be obliterated and reclaimed. The Operator must notify the Great Falls Field Station (GFFS) on an annual basis, which roads, including private, are to be closed. In the case where the road is on private surface, reclamation and obliteration will be at the discretion of the private land-owner, but it will be the responsibility of the Operator to either perform the work or assure the work is done.

2. ACCESS ROADS TO BE CONSTRUCTED AND RECONSTRUCTED

In all road situations, every Operator is highly encouraged to establish a working relationship with the private land-owners in this area. Since the land-ownership is mixed and new roads can cross a variety of owners, it is imperative that each Operator take the responsibility to be a good neighbor.

In situations on private lands where new roads are built or old roads are reconstructed, written permission will need to be obtained from the private land-owner. This applies to both on-lease and off-lease situations. This permission must be submitted before the APD will be approved. ***For federal lands, both off lease and on lease, please contact either the GFFS or Malta Field Office.***

Future and systematic development of a transportation network that serves all Operators in North Phillips County may involve requiring Operators to look at locating roads with the philosophy of "one road in - one road out" of each well location. This philosophy is an attempt to eliminate or curtail the "spider web roads" which are being made in the affected areas.

New roads on level or nearly level ground will not be bladed unless required by the GFFS. Once these roads are established, the Operator will be required to use these "roads/trails" for access. The Operator may also be responsible for drainage (See Section C below) as specified by GFFS. Shortcutting of roads/trails will not be allowed. Any Operator found to be shortcutting established roads/trails will be required to obliterate the trail and compensate the private land-owner for damage.

Road Junctions will be located where site distances are adequate for safe entry and exit. All turns, including junctions, will have radii large enough to handle anticipated truck traffic for both drilling and production. Maximum grades will generally not exceed 10% except for pitch grades (i.e. road sections less than 300 feet).

When new access roads have sustained maximum grades steeper than 10%, on sections longer than 300 feet, or where roads cross side slopes steeper than 25%, the Operator will consult with the Lewistown Field Office Civil Engineer under advisement of the GFFS. If he deems necessary, the Operator will secure the services of a licensed professional engineer to design a safe, stable road. Vertical alignment diagrams, cross sections and other engineering studies may be completed as necessary to assure sound engineering practices and proper road construction. Roads will be abandoned in accordance with Point 10.

A. CLEARING AND GRADING - Suitable topsoil will be stripped to an average depth of six inches and stockpiled for subsequent application on the in slopes and back slopes of ditches; where needed, the GFFS may require mulching, seeding, and fertilization before final abandonment in order to make up for lost topsoil. The seeding mixture to be utilized is shown in Point 10.

B. ACCESS DURING CONSTRUCTION - Construction related traffic will be restricted to the disturbed area needed for construction of the roadway.

C. DRAINAGE

1) Culverts, ditches and other drainage features will be designed to handle anticipated runoff events, i.e. 25 year event. Surface cover, slope, length of drainage, return times, channel cross sections and gradients will be considered as appropriate in the hydraulic and engineering analysis of upstream areas to determine the amount of runoff during the life of the access road. To assure proper drainage, the normal standard road will be ditched and crowned and constructed to the following specifications as authorized by the GFFS:

WIDTH OF RUNNING SURFACE	12-14 Feet
DISTURBED AREA (DITCH TO DITCH)	20 Feet
DEPTH OF DITCHES	1 Foot Minimum

A lesser standard may be used where little use occurs, but proper drainage dips will be installed as needed.

On extremely steep side hills or other difficult terrain where cramped conditions make the road standard costly and create potential hazards to road users, the Operator may in consultation with the BLM engineers employ a different standard. Drainage will be managed in accordance with other parts of the guidelines. If this solution results in excessive erosion or sediment loss, the Operator must modify it to fix the problem.

2) Culverts will be used for all minor drainage crossings, unless debris problems, low runoff volume or traffic volume justify the use of a drainage dip. Drainage dips will be located to provide safe stopping sight distances, constructed such as to be stable and self cleaning, and will not cause serious erosion or sedimentation, especially at the outlets. Drainage dips will be placed at intervals as recommended by the GFFS.

3) In most cases culverts will be 18 inches in diameter. Backfill will be thoroughly compacted, and minimum cover over culverts will be 12 inches or 1/2 the culvert diameter, whichever is greater. In steep, broken terrain where the ditch depth, culvert cover and other design standards necessary for 18 inch culvert installation are impractical and often counterproductive, the Operator may employ smaller pipes (12 inch or greater diameter) in consultation with the GFFS. If casing is used, flanges or other effective anchoring devices will be attached. Cover over casing may be reduced to four inches. If this accepted practice causes plugged pipes, unstable and unsafe roads or unacceptable environmental damage, it will be discontinued.

4) Culverts used as laterals to provide cross drainage between natural drainages will be placed such that they are skewed to form an entrance angle of 45 degrees to 60 degrees with the side ditch, and have a gradient equal to or slightly greater than the approach ditch gradient. Suitable ditch blocks will be constructed below culvert inlets.

5) Culverts in drainages will be placed on firm, uniform beds which have been shaped to accept them, aligned with the natural channel and set at a gradient that maintains the natural drainage velocity so sedimentation

or erosion is not increased and will allow amphibian or fish travel through the culvert.

6) The inlets and outlets of culverts will be modified as necessary to protect from debris and limit excessive channel scour and erosion. The modifications may include racks, cribs, raisers, drop inlets, downspouts, energy dissipaters, flared ends, headwalls, and riprap.

7) In areas where near-surface water exists on the roadway, or is exposed by continual use, the Operator will be required to implement a drainage system to clear the water off the roadway or to re-route the roadway away from these "low spots". The Operator will not be allowed to detour in ever-widening circles around these low spots thus creating a large mudhole in the roadway.

D. **SUB GRADE AND SURFACING** - The newly constructed subgrade will be bladed and shaped as necessary to prepare a safe, stable road bed, compacted, and then graveled if necessary for safety, drainage or stability.

3. LOCATION OF EXISTING WELLS

Maps showing the location of existing wells will only be submitted when specifically requested by the BLM.

4. LOCATION OF EXISTING AND/OR PROPOSED FACILITIES IF WELLS ARE PRODUCTIVE

All new permanent production structures, other than
wellheads and electrical devices, that can be seen from a distance of 1/4 mile will be painted Yuma Green or Desert Brown as outlined in the Bowdoin EA. Color charts are available from the GFFS or MaFO offices. The exception to these painting requirements would apply only to those portions requiring OSHA Safety Colors.

Construction activity for flowlines and power lines will be restricted to a route no more than ***fifty*** feet wide (***25'*** on either side of the centerline). After construction is completed, the route will NOT be used as a road, unless approved by the GFFS. All permanent liquid transfer lines, on the surface for more than one year, will be buried once approval is obtained from the GFFS.

A. PIPELINES

1) Flagging and Staking - The center-line of the pipeline right-of-way will be surveyed and/or pin flagged prior to any surface disturbing activities. On slopes greater than 25% or on rugged terrain, slope grade, and other construction control stakes may be necessary to ensure proper construction. If stakes are disturbed, they will be replaced before proceeding with construction.

2) Construction

a) All underground steel flowlines will be coated or otherwise protected from external corrosion and will be aligned in as straight a line as possible, and buried to a sufficient depth below frost line, generally three to four feet deep.

b) Where possible, clearing along the pipeline route will be limited to the topping of shrubs and grasses up to an inside width of 26 feet. Where surface conditions prohibit the safe use of construction equipment, existing grades will be modified. Where supplemental grading is needed, an average of six inches of topsoil will be windrowed along one side of the modified areas, for storage before construction begins. Topsoil will be kept separate from trench soil.

c) The unbladed portion of the ***50'*** wide right-of-way will be utilized by trucks and other pipeline laying equipment. This portion will NOT be flatbladed.

d) When the trench is backfilled, it will be compacted to the approximate bulk densities of the adjacent undisturbed soils and restored to natural ground level. To prevent improper settling of soil material, frozen or saturated soils will not be used during backfilling. Windrows or crowning using the natural settlement method may be used instead of compaction. All soil windrows will be removed when reclamation is completed (i.e., discing/seeding).

e) Drainage crossings will be constructed to prevent any blocking, diversion, or restriction of the existing channel. The pipelines spanning drainages will provide adequate clearance for anticipated stream flow resulting from a 25 year storm event. Drainage spans must be approved prior to installation of pipe.

f) No more than 2500 feet of unattended or unprotected open trench will be allowed overnight without warning devices such as signs, flares, warning lights, or inspection personnel. Areas considered hazardous to people, livestock or wildlife will be fenced to reasonably prohibit entry. Warning devices such as flares, signs, flagging, barricades, lights, etc. will normally be used for unattended or unprotected open trenches in other areas not considered hazardous to people, livestock or wildlife. The amount of ditch to be left open is dependent upon the location and circumstances surrounding the situation.

g) Any changes in product metering along the pipeline route will require prior approval from the GFFS. Rights-of-way will be needed for all pipelines downstream of the meter or custody transfer point that are off unit or off lease and on BLM surface. These rights-of-way are approved by MaFO.

h) Any pipelines which bisect or are within 100' of sensitive environments such as wetlands (intermittent, ephemeral or perennial), riparian zones, prairie dog towns or any environment which is suspected to contain either federal or state threatened, endangered or sensitive

species, including plants and animals or cultural resource sites, will be re-routed around these environments. In the event the re-route cannot be done for environmental reasons, the pipeline route will be mitigated and approved by the GFFS prior to surface disturbance.

3) Operations and Maintenance - Pipeline trenches will be maintained in order to correct settlement and erosion. Waterbars and other erosional control devices will be maintained. When new construction occurs on an existing right-of-way, reasonable care will be taken to protect the pipe from damage or breakage. Adequate soil cover will be retained on buried pipes to prevent freezing and breakage.

B. **POWER LINES** –To obtain electrical power, minimum disturbance power lines may be constructed to well sites. Approximately 45' from the last pole of each line and 100' from the receiving wellhead, a service pole will be set and connected to the well by means of a buried cable.

1) Construction - Dirt work will be limited to drill holes for poles and anchors, and trenching in the buried cable. Excess soil excavated from the pole and anchor holes will be spread evenly in the immediate vicinity of the pole structure or coned around the pole to allow for settling.

2) Raptor Protection - All newly constructed or modified structures will meet or exceed features illustrated in the booklet "Suggested Practices for Raptor Protection on Power Lines. The State of the Art in 1981" (Raptor Research Report No. 4, Olendorff, Miller, and Lehman, Raptor Research Foundation, University of Minnesota, St. Paul).

5. LOCATION OF WATER SUPPLY

Drilling water will be transported by means of a temporary surface line or by truck. Water wells will not be drilled on public lands without prior written approval from the GFFS, or on private or state lands without prior written approval of the MT Board of Oil and Gas.

Water obtained from a BLM stockpond will need an authorization from MaFO. Approval of this will include determinations of sufficient water for livestock and wildlife and an adequate supply of surplus water. It is advised that Operators pursue all means of utilizing private water before applying for federal stockpond water. Operator must secure legal access to water, either through land-owner permission, contract or State temporary water use permit. The legal access document must be available upon request by the BLM.

All Operators must submit with the APD a map detailing the location(s) of the water source and mud disposal.

6. CONSTRUCTION MATERIALS

On-site materials will be used for building locations and roads. Gravel, if needed, must be obtained from noxious weed-free sources. MaFO has a listing of approved gravel pits.

7. METHODS FOR HANDLING WASTE DISPOSAL

Cuttings and drilling fluids will be disposed of in the reserve pits or may be recycled to the next drilling location.

A. CUTTINGS AND RESERVE PIT FLUIDS - RESERVE PITS

1) All reserve pits will be constructed to assure that, at reclamation, the cuttings can be covered with at least three feet of fill, and that the filled areas closely resemble natural, pre-existing contours.

2) Pits may be required to be lined in porous soils, on steep and unstable slopes, or where communication between the pit contents and groundwater may occur. This will be determined by the GFFS after consultation with the BLM soil scientist. Liner specs, when needed, can be requested at the GFFS office.

3) At least half the depth of the reserve pits will be in native cut. Where the pits are above ground level, the dike will be keyed and constructed in 8-inch lifts. Each lift will be compacted using rubber tired equipment.

4) Following rig release, reserve pits will be fenced, stock tight, unless the following condition can be met:

Between drilling and completion, the Operator is responsible for ensuring livestock or wildlife are not trapped in unfenced pits.

Should there be any hydrocarbons on the pit, the hydrocarbons will be removed or netting will be installed until the hydrocarbons can be removed or personnel will remain on-site to deter birds until the hydrocarbons are removed.

5) Final backfilling will comply with Point 10.

B. WASTE AND SANITATION

The Operator will comply with all State and Local laws and regulations pertaining to disposal of human and solid waste. All fields will be maintained in a sanitary condition at all times. Any sewage will be disposed of in portable chemical latrines. Garbage and other waste material will be gathered and disposed of in an approved sanitary landfill. No burning or burying will be allowed.

The Operator will generally not be allowed to dispose of drilling mud in BLM stockponds or reservoirs or on public lands unless prior approval has been given, in writing, by the MaFO. In certain instances, approval may be given IF the mud contains ONLY bentonite and water AND the reservoir or stockpond is in need of a clay sealing liner. The Operator is encouraged to discuss with the MaFO situations of drilling mud disposal which meet the above criteria, prior to the drilling season.

C. HAZARDOUS MATERIALS

Operators and their contractors are to ensure all production, use, storage, transport, and disposal of hazardous materials resulting from the proposed project is in accordance with all applicable Federal, state and local laws, regulations and guidelines, existing or hereafter enacted or promulgated that effect the management of hazardous material, as defined in this paragraph. Hazardous material means any substance, pollutant, or contaminant listed as a hazardous substance under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended, 42 USC 9601 et seq., and its regulations (found at 40 CFR 302). The definition of hazardous substances under CERCLA includes and "hazardous waste" defined in the Resource Conservation and Recovery Act (RCRA) of 1976, as amended, 42 USC 6901 et seq., and its regulations. The term also includes any extremely hazardous substances defined by 40 CFR 355, and any nuclear or byproduct material defined by the Atomic Energy Act of 1954, as amended, 42 USC 2011 et seq. The term does not include petroleum, including crude oil or any fraction thereof not otherwise listed or designated as a hazardous substance under CERCLA section 101 (14), 42 USC 9601 (14), or natural gas.

Only drilling muds, drilling fluids, cuttings, native soils, cementing materials and/or approved pit solidifying materials will be placed in the reserve or working pits.

Nonexempt wastes will not be mixed with exempt wastes.

No hazardous materials will be used in the drilling and construction of well sites and access roads. Commercial preparations, which may contain hazardous materials may be used in production operations and will be transported with the project area. These materials will be handled in an appropriate manner to minimize potential for leaks or spills to the environment. No hazardous wastes will be generated in the well drilling operation. Other waste disposal methods and locations should be described on the APD or SN and approved by GFFS prior to disposal.

D. PRODUCED SEDIMENTS

Sediments produced by "blowing down the well bore" during the life of the well must be disposed of at the time of well abandonment. Disposal methods may include burying under sufficient depth (generally 3') and covering them with topsoil. These sediments will not be allowed to remain on the surface after abandonment, nor tilled in with the surface soil horizons. Other methods of disposal must be approved by the GFFS prior to well abandonment.

Large amounts of "frac sand" must be spread evenly around the well location, but may remain on the surface and do not have to be buried. If the sand is of sufficient depth that precludes vegetation re-growth, the sand must be tilled into the top layers of the soil. This can occur at any time, but generally should be done at well abandonment. Soil amendments, as determined by the GFFS, may be necessary to return the site to productivity.

E. OTHER METHODS

Other methods of waste disposal or production such as closed systems, fiberglass tanks, landfarming, "leach" fields, etc. must be approved by GFFS prior to implementation.

8. ANCILLARY FACILITIES

Ancillary facilities will be temporary, consisting of three to four trailer houses on the location for authorized personnel. No camps or airstrips will be constructed.

COMPRESSOR STATIONS ON FEDERAL LANDS

Applications for these types of facilities require additional analysis and discussion and therefore will not be considered in this document. The Operator must notify GFFS if considering installing these facilities on federal lands.

9. WELL SITE LAYOUT

The location of mud tanks, reserve pit, pipe racks, living facilities, topsoil and spoil piles will be shown on maps. See Exhibits 3 and 4. No formation fracturings with volatile fluids are anticipated in normal drilling operations. However, all drill pads will be designed to comply with safety regulations for a frac using volatile fluids.

A. FLAGGING AND STAKING

Staking of the location will include two 250' directional survey reference stakes with the exterior boundaries of the pad marked with corner and centerline stakes. Pits will also be marked with corner stakes. Where drainage or rugged slopes create special problems, additional staking may be necessary to ensure construction in accordance with this document. If stakes are disturbed, they will be replaced before construction is commenced.

B. CLEARING AND GRADING

1) Approximately six inches of topsoil (e.g. at least 1000 cubic yards for each drilling location) will be removed and stockpiled from the location prior to any pad or pit construction. Burial of topsoil under fill material will be prohibited.

2) The Operator(s) will limit the degree of surface disturbance and vegetation removal wherever possible, when safety is not compromised. Where surface disturbance cannot be avoided, all practicable measures will be used to minimize erosion and stabilize disturbed soils. This will reduce the amount of reclamation needed and lessen the amount of disturbance to the rooting zone and topsoil.

C. EROSION CONTROL

If necessary, well pads will be designed to minimize or prevent soil erosion, especially on fill slopes. Measures that may be implemented include erosion mats, culverts, berms, or immediate reseeding of unused pad areas. Any measures will be at the discretion of the GFFS.

10. SURFACE RECLAMATION PLANS

All equipment, hardware, waste or debris will be removed prior to any reclamation or stabilization actions. This includes risers, power line connections including poles, metersheds, fences, electric powerboxes, etc. Pipelines may be purged, but only after consultation with the GFFS. All surface portions of pipelines will be removed, unless excepted by GFFS.

Linear disturbances such as newly constructed or reclaimed pipelines or roads, will be cross drained by water bars. Water bars should be constructed 1-2' deep. The bars should begin and end in undisturbed soils and be constructed parallel to the slope contour with a slight grade to facilitate water runoff. Any slope over 3:1 in steepness and longer than 50' should have at least one water bar to break the slope down to 25' lengths. In soils that normally do not support adequate vegetation to prevent erosion, i.e. acid shales or any site specific area determined by the GFFS to be at risk to excessive erosion, water bars should be constructed every 25' on anything steeper than 5:1. On short, steep grades, additional erosional control structures will be installed as determined by local conditions.

A. INTERIM STABILIZATION AND RECONTOURING

Unused areas around wellpads, unused pits, flowline rights-of-way, cut and fill slopes of roads, and any other surfaces not occupied for field use, will be graded to form stable, rounded slopes that blend with the natural terrain. To prevent improper settling of soil material, grading will not be done when frozen or saturated soil conditions exist. Water bars or other erosion control structures will be built as needed, the areas will be ripped, the topsoil replaced, and the areas seeded as per final abandonment practices. This will occur within 3 months of well completion or the next seeding window, whichever occurs first.

B. FINAL RECONTOURING FOR PRE-ABANDONMENT

1) All wells will be completely plugged in accordance with the standards stated in the Conditions of Approval for the NIA before recontouring and reclamation begin.

2) Pipelines will be purged of all fluids, as necessary, and the fluids will be disposed of in accordance with measures outlined in Point 7.

3) Before recontouring takes place, the stockpiled topsoil and vegetative material will be scraped from cut and fill slopes of roads and pads where stable vegetation has occurred. It will be stockpiled for final distribution after the area is recontoured. The point is NOT to bury good topsoil that has been previously placed on pad edges or road back slopes.

4) Before well pads and battery areas are recontoured, oily surface material and cuttings (provided they are not regulated under RCRA, CERCLA, or other applicable regulations) and severely compacted soils should be worked and broken into aggregates of one inch in diameter or smaller, then treated with at least 200 lbs. of ammonium nitrate (33-0-0)/acre, or horse manure, working it into the material. This should be conducted before available topsoil and vegetation is spread on the surface for seed bed preparation. Additional fertilizer may be needed to establish the desired plant growth.

5) All disturbed areas (roads, pads, flowline, etc.) will be graded to the original approximate contour. If the disturbed area has stabilized through non-use and if putting the area back to original contour will cause additional disturbance, then recontouring may not be required. This must be approved by the GFFS.

6) Drainages will be reclaimed to approximate the original bank configuration, stream bottom width, and channel gradient. Any pilings, debris, or other obstructions will be removed from the drainage channels.

7) All roads no longer needed for access will be abandoned and marked at each end of such access by rocks which have been painted florescent green to indicate that access is no longer in effect. This trail may then be rehabilitated and seeded per GFFS.

C. PITS

Burn pits, reserve pits and any other pits will be filled, leveled or sloped to resemble adjacent terrain, when no longer needed. Cuttings and drilling muds will be allowed to dry, and then all contents including liners will be covered with at least three feet of uncontaminated soils.

D. SEEDING AND SOIL AMENDMENTS

1) All disturbed areas will be seeded with the certified weed-free seed mixture below. Available substitutes having similar ecological characteristics may be used with prior approval from the GFFS.

SPECIES/MIXTURE	RATE (PLS)
Western Wheatgrass	4 lbs/ac
Thickspike Wheatgrass	4 lbs/ac
Green Needlegrass	2 lbs/ac

DO NOT SEED WITH NON-NATIVE YELLOW SWEETCLOVER.

2) The certified weed-free seed mixture shall be planted in the amounts specified in pounds of pure live seed (PLS) per acre. There shall be NO primary or secondary noxious weed seed in the mixture. Seed shall be tested and the viability testing shall be done in accordance with Montana State law(s). Commercial seed shall be either State certified or registered seed. The certified weed-free seed mixture container shall be tagged in

accordance with State law(s) and available for inspection by either GFFS or MaFO.

Procedures for properly preparing the seed bed vary with each site. The objectives of reclamation are to re-establish a growing stand of vegetation similar to the adjacent, untouched ground. In all cases the following parameters of re-vegetation must be achieved:

a. The seed must be covered with 1/4-1/2" of soil.

b. The ground must be scarified to allow the seed to establish roots, protect the surface from wind erosion and for maximum rain and snowfall retention.

c. The amount of seed must be enough so that upon germination, the soil is adequately covered. Sparse or spotty vegetation re-growth is not acceptable.

d. The mixture of seed must be diverse enough to show a variety of native desirable plants upon germination. Monocultures will not be allowed.

e. Fertilizer and/or mulching or other supplemental treatments may be necessary to establish a growing stand.

f. Seeding will not be allowed in frozen or saturated soil conditions.

3) As much seeding as possible will be conducted during the fall before the ground freezes. Occasional seeding may occur in the spring as long as the ground is not saturated. Seeding will be repeated until a satisfactory stand is obtained.

11. OTHER INFORMATION

A. Noxious weeds will be controlled on disturbed areas in accordance with guidelines established by the EPA, BLM, State, and local pesticide authorities. Appropriate measures, such as chemical, biological or mechanical will be followed to prevent the spread of weed infestations and reduce potential for spreading weed seed via equipment use. This may include, but not be limited to, washing rig frames and all drilling equipment prior to entry onto public lands.

B. FENCES

1) Prior notification will be made to the MaFO, when a fence used for livestock control must be cut. The gap will be managed to prevent the passage of livestock by either placing a cattleguard (if regular or frequent passage is necessary) or constructing a wire gate. Fences will be braced and tied off before cutting to prevent slacking of the wire. At completion of construction, the fence will be repaired to a standard as good as or better than what previously existed. In any case, previously existing

management of livestock will be restored. Removal of the cattleguard/gate at the time of abandonment will be at the discretion of the MaFO or the private land-owner.

2) Construction and installation of cattleguards will be to industry standards and will allow safe passage of vehicles. They will be as wide as the running surface of the road and at least six feet along the other dimension, and will be set on timber or cast-in-place concrete bases at right angles (90 degrees) to the roadway. Backfill around cattleguards will be thoroughly compacted. Bypass gates will be built adjacent to each cattleguard structure. Maintenance of the cattleguard will be the responsibility of the Operator.

C. CULTURAL RESOURCES

1) The Operator shall not disturb the surface of the lease until a cultural resource inventory has been conducted by a professional archaeologist acceptable to BLM for the specific area on which surface disturbing activity is planned. For tribal minerals or surface, please contact GFFS for further instructions.

2) If archaeological or historical materials or human remains are discovered during operations, the Operator shall suspend all operations that may further disturb such materials or remains and immediately contact the GFFS. Operations are not to resume until written authorization to proceed is issued by the GFFS. Within five (5) working days, the GFFS will evaluate the discovery and inform the Operator of actions that will be necessary to prevent loss of significant cultural resource values or human remains. The Operator may be responsible for the cost of mitigation required by the GFFS.

3) The Operator shall be responsible for insuring that cultural resources recorded near the area of proposed surface lease operations are not inadvertently damaged during the construction, use, maintenance and abandonment phases of the drilling and production program. Damage, alteration or removal of these resources which are attributable to the Operator's activities may be subject to penalties under the Federal Land Policy and Management Act (FLPMA) and/or the Archaeological Resources Protection Act (ARPA).

4) A standard "avoidance" color for flagging all cultural sites will be blue.

5) If paleontological resources are discovered, the Operator will be responsible to follow the procedures in Item #2 above.

D. GENERAL CONDITIONS OF APPROVAL FOR APDS

1) Approval of APDs does not warrant or certify that the applicant holds legal or equitable title to those rights in the subject lease which would entitle

the applicant to conduct operations thereon. In addition, approval of APDs does not imply that the Operator has legal access to the drilling location. For private surface, on lease, 43 CFR 3814 regulations must be complied with for the portion of the access road and the drilling locations.

2) APDs are valid for a period of two years from the date of approval or until the oil and gas lease expires/terminates, whichever occurs first. If the APD terminates, any surface disturbance created under the application must be reclaimed in accordance with the approved plan.

3) All applicable local, state and/or federal laws, regulations, and/or statutes must be complied with.

4) A complete copy of the approved APD must be at the drill site during the construction of the roads and drill pad, the drilling of the well, and the completion of the well.

5) Individual spud dates will be reported orally to the GFFS, 24 HOURS PRIOR TO SPUDDING, unless otherwise required in site specific conditions of approval.

6) Verbal notification shall be given to the GFFS at least 24 hours in advance of formation tests, BOP tests, running and cementing casing (other than conductor casing), and drilling over lease expiration dates. Notice will also be given 24 hours prior to any construction activity approved under an APD or Sundry Notice.

7) Reports and Notifications (3162.4-1, 3162.4-3, Operating Form chart at beginning of 43 CFR Part 3160)

   a) Form 3160-4, Well Completion or Recompletion Report (in duplicate) plus one copy of the log, due 30 days after well completion.

   b) One copy Of MMS Form 3160, Monthly Report of Operations, for each calendar month, beginning with the month in which drilling operations are initiated. This report is due to Mineral Management Service on or before the 15th day of the second month following the month of production (e.g., the report for May is due on July 15).

   c) Section 102(b)(3) of the Federal Oil and Gas Royalty Management Act of 1982, as implemented by the applicable provisions of the operating regulations at Title 43 CFR 3162.4-1(c), requires that "not later than the 5th business day after any well begins production on which royalty is due anywhere on a lease site or allocated to a lease site, or resumes production in the case of a well which has been off production for more than 90 days, the Operator shall notify the authorized officer by letter or Sundry Notice, Form 3160-5, orally to be followed by a letter or

Sundry Notice, of the date on which such production has begun or resumed."

The date on which production is commenced or resumed will be construed for oil wills as the date on which liquid hydrocarbons are first sold or shipped from a temporary storage facility, such as a test tank and for which a run ticket is required to be generated, or the date on which liquid hydrocarbons are first produced into a permanent storage facility, whichever first occurs; and, for gas wells, as the date on which associated liquid hydrocarbons are first sold or shipped from a temporary storage facility, such as a test tank, and for which a run ticket is required to be generated or, the date on which gas is first measured through permanent metering facilities, whichever first occurs.

Operators who fail to comply with this requirement in the manner and time allowed, shall be liable for a civil penalty of up to $10,000 per violation for each day such violation continues, not to exceed a maximum of 20 days. See Section 109(c)(3) of the Federal Oil and Gas Royalty Management Act of 1982 and the implementing regulations at Title 43 CFR 3163.2(E)(2).

d) Pursuant to Onshore Oil and Gas Order No. 1, Section IV, General Operating Requirements, Operator Responsibilities, paragraph (e), Completion Reports, Operators are encouraged to submit all well logs in an electronic format, such as ".LAS" format, in lieu of providing the BLM with two (2) paper copies of all well logs, as currently required.

8) The Operator shall be responsible for the prevention and suppression of fires on public lands caused by its employees, contractors or subcontractors. During conditions of extreme fire danger, surface use operations may be limited or suspended in certain areas. Operator will be notified by the MaFO when such conditions are in effect.

9) All survey monuments, both official and recognizable civil, found within the area of operations shall be protected. In the event of obliteration or disturbance of any survey monuments, the incident shall be reported to the GFFS or MAFO. A system will then be implemented to re-monument the marker, as authorized by the BLM.

10) If at any time the facilities located on public lands authorized by the terms of the lease are no longer included in the lease (due to contraction in the unit or other lease or unit boundary change) the GFFS will process a right-of-way authorization to conform with the appropriate statute. This change in authorization will apply to off-lease portions of pipelines, roads and well pads. The authorization will be subject to appropriate rentals, or other financial obligation determined by the MaFO.

11) Mitigation measures in the "Bowdoin EA" that are in effect to protect wildlife are:

a) Access routes that need to be built prior to June 30th could be approved by MaFO Biologist prior to using the route (Ch IV, Section H).

b) No water will be taken from public land reservoirs from May 1 to June 30 (Ch IV, Section H).

c) No development will occur within 1/4 mi of wetland basins containing suitable piping plover nesting habitat during May 15 to July 30. If drilling is proposed within the window and at less than a 1/4 mi, a survey will be done prior to approval. If plovers are found, the activity will not be permitted until after July 30 or are cleared by the USFWS (Ch IV, Section I).

E. WELL ABANDONMENT

1) The GFFS will be notified sufficiently in advance of actual plugging work so that a representative may have the opportunity to witness the operation.

2) Prior approval for abandonment must be obtained. Initial approval for abandonment during drilling operations may be verbal but must be followed by written notification on form 3160-5, in triplicate.

3) Upon completion of the approved plugging, the Operator will cut the well off at least three feet below reclaimed ground level and a ¼" x 12" x 12" plate will be welded onto a fitting to be screwed into a collar either welded or screwed to the production casing. The standard dry-hole marker in accordance with 43 CFR 3162.6(d) has been waived by the Great Falls Field Station unless the Surface Management Agency (SMA) or the private land-owner requires a dry-hole marker (DHM) to be set. Should it be desired that the DHM be set, the DHM will be a piece of pipe (preferably 4¼" casing) and extend approximately 4 feet above ground level. The top of the DHM will be closed or capped. The DHM will be screwed into a collar that has been either welded or screwed to the production casing. By screwing the DHM or plate into the well, this will allow easier reentry into the wellbore, if future problems exist with the well. It will also be a requirement under this Master APD that pipe thread compound be used to make-up and prevent corrosion on the described fittings above.

In either case of a plate or the DHM, an _" weep hole will be left in the pipe or the plate. To allow for any settling of the cellar, dirt will be heaped up around the base of the marker or above the well about 18 inches. Both the plate or the DHM will have the following information placed on the plate/post by beading on with a welding torch:

"Fed" or "Ind" as applicable; Operator Name, Lease serial number, well number, location by 1/4, 1/4 section, township, range."

4) Within 30 days after well bore plugging operations are completed, Form 3160-5(Subsequent Report of Abandonment) must be filed showing location of plugs, amount of cement in each, amount of casing left in hole, and status of surface restoration.

5) All reclamation work will be done within one year of plugging, unless an exception is granted by the GFFS. Failure to finish the surface reclamation work within this year will result in the issuance of an INC.

F. PRODUCED WATER DISPOSAL

1) The Operator will follow the procedures in Onshore Order #7 for injection wells, disposal wells and surface discharge. For wells which produce less than 5 bwpd, the following items will be submitted for pit approval:

   a) Form 3160-5, Sundry Notice cover page which will state: the amount of water produced daily, soil permeability/percolation rate and soil type.

   b) Water analysis.

   c) All pits will be no larger than 40' x 40' x 4' (top of berms) and must contain the produced water through all seasons.

   d) All pits will be fenced with preferably corral panels or with 4-strand barbed wire (as diagrammed in OO#7). A fence diagram will no longer be submitted.

2) Since the remaining required items are common for the Bowdoin fields, the GFFS will no longer require the submittal of the following items unless requested:

   pit diagram, mean annual evaporation map, well location topography, soil listing(s) from reference manual, fence diagram and mean annual precipitation map.

3) The pit can be lined with bentonite, a common soil element in the area. The GFFS may require additional lining as needed, for conditions of rapid soil permeability, high TDS counts (over 10,000 TDS), where communication between pit contents and groundwater may occur or in sensitive waterfowl environments.

4) If the Operator wants to fill MaFO stockwater impoundments with excess freshwater, the Operator must first consult with GFFS whom will then coordinate with MaFO range and wildlife biologists.

5) All pits will be subject to the following condition:

You are required to take all necessary steps to prevent any death of a migratory bird in pits or open vessels associated with the drilling, testing, completion or production of this well. The death of any migratory bird found in such a pit or open vessel is a violation of the Migratory Bird Treaty Act and is considered a criminal act. Any deaths of migratory birds attributable to pits or open vessels associated with drilling, testing, completing or production operations must be reported to this office and the US Fish and Wildlife Service within 24 hours.

We may require that the pit be designed or the 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.

Voluntary pit fencing, screening, and netting or sealing vessels is encouraged to avoid potential instances that may result in the death of a migratory bird.

6) The transfer of produced water from one well location to another is permitted under the following conditions:

a) If the water is dumped in another unit, field or PA, permission of that Operator must be obtained, in writing, prior to dumping.

b) The mixing of produced waters with waters greater than 10,000 TDS will not be allowed to mix with lesser TDS's.

c) Water greater than 10,000 TDS cannot be dumped in an unlined pit.

d) The receiving pit must meet the standards of OO#7 and be a BLM or state-approved pit, prior to dumping.

7) This office must be notified if the quantity and/or quality of water results in the pit to no longer meet the unlined pit criteria or pit enlargement is necessary due to an increase of produced water.

G. OTHER SMA'S PERMITTING SYSTEMS (FWS, BOR, PVT, STATE)

The Operator may be required to submit all necessary right-of-way and surface use/damages permits from other SMAs prior to APD approval, if requested by the BLM.

12. ROUTINE MAINTENANCE CONSIDERATIONS

A. **New construction** will not take place in wet and unstable soils. Routine maintenance of prepared road and pad surfaces will take place when soils are dry enough to prevent rutting or serious erosion. Unplanned construction to control spills, fires, and other undesirable events will occur at any time.

B. **Normal day-to-day routine operations** which do not require prior written approval from the GFFS:

1) Routine maintenance of existing lease roads which does not widen or otherwise extend existing surface disturbance.

2) Repairing or replacing existing culverts which does not require additional surface disturbance.

3) Repair or replacement of 500' or less of existing pipelines which does not require additional surface disturbances, except in sensitive environments, which includes wetlands, prairie dog towns, riparian/streambank areas and cultural resource sites. In these cases, notify the GFFS.

13. SIGNS

New well signs shall have the following information contained on them:

A. Well Name and Number

B. Name of Operator

C. The Lease Serial Number

D. The Surveyed Location

1) 1/4, 1/4 Section, Section, Township, Range (Footages are Optional)

2) Or other authorized survey designation acceptable to the authorized officer.

E. Unit or Communitization Name or Number

F. Name of the Indian Allottee Lessor(s)

CONTACTS - BUREAU OF LAND MANAGEMENT

The primary contact for all oil/gas operations in the above listed areas (Phillips and portions of Valley County) is the Great Falls Field Station. Please notify that office before implementing surface-disturbing activities. Situations which may require Malta Field Office involvement will be coordinated by the GFFS.

GREAT FALLS FIELD STATION
1101 15th St N
Great Falls, Montana 59401
(406)791-7700

MALTA FIELD OFFICE
501 South Second Street, E.
Malta, Montana 59538
(406) 654-5100

PETROLEUM ENGINEERS

Barney Whiteman	(406) 750-3417
Dale Manchester	(406) 454-2402

PETROLEUM ENGINEERING TECHNICIAN

Lisa-Marrie Fox	(406) 727-5114
Donna Mitchell	(406) 727-2239
Steven McCracken	(406) 964-1039

MINERAL RESOURCE SPECIALIST
(SURFACE CONCERNS AND REPORTING OF UNDESIRABLE EVENTS)

Andrea Parrott	(406) 952-0067

Appendix B

Potential Bird Species Within or Near the BNGPA

Table B-1. Occurrence Potential and Pertinent Wildlife Section of Bird Species Within or Near the BNGPA

Common Name[1]	Scientific Name	Occurrence Potential[2]	Wildlife Section[3]
Alder Flycatcher*	*Empidonax alnorum*	t	M
American Avocet	*Recurvirostra americana*	B	SWB
American Bittern	*Botaurus lentiginosus*	B	SWB
American Black Duck	*Anas rubripes*	t	SWB
American Coot	*Fulica americana*	B	SWB
American Crow	*Corvus brachyrhynchos*	b	M
American Golden-Plover	*Pluvialis dominica*	t	SWB
American Goldfinch	*Carduelis tristis*	B	M
American Pipit	*Anthus rubescens*	t	M
American Redstart	*Setophaga ruticilla*	t	M
American Robin	*Turdus migratorius*	B	M
American Tree Sparrow	*Spizella arborea*	t	M
American Wigeon	*Anas americana*	B	SWB
Baird's Sandpiper	*Calidris bairdii*	t	SWB
Baird's Sparrow*	*Ammodramus bairdii*	B	M
Baltimore Oriole	*Icterus galbula*	B	M
Bank Swallow	*Riparia riparia*	B	M
Barn Swallow	*Hirundo rustica*	B	M
Barrow's Goldeneye	*Bucephala islandica*	t	SWB
Bay-breasted Warbler	*Dendroica castanea*	t	M
Belted Kingfisher	*Ceryle alcyon*	b	M
Black-and-white Warbler*	*Mniotilta varia*	t	M
Black-bellied Plover	*Pluvialis squatarola*	t	SWB
Black-billed Cuckoo	*Coccyzus erythropthalmus*	B	M
Black-billed Magpie	*Pica pica*	B	M
Black-capped Chickadee	*Poecile atricapillus*	B	M
Black-headed Grosbeak	*Pheucticus melanocephalus*	t	M
Black-necked Stilt	*Himantopus mexicanus*	B	SWB
Black-throated Green Warbler	*Dendroica virens*	t	M
Blackburnian Warbler	*Dendroica fusca*	t	M
Blackpoll Warbler	*Dendroica striata*	t	M
Blue Grosbeak	*Guiraca caerulea*	t	M
Blue Jay	*Cyanocitta cristata*	B	M
Blue-winged Teal	*Anas discors*	B	SWB
Bobolink*	*Dolichonyx oryzivorus*	b	M
Bohemian Waxwing	*Bombycilla garrulus*	W	M
Brewer's Blackbird	*Euphagus cyanocephalus*	B	M
Brewer's Sparrow*	*Spizella breweri*	B	M
Brown Creeper	*Certhia americana*	t	M
Brown Thrasher	*Toxostoma rufum*	B	M
Brown-headed Cowbird	*Molothrus ater*	B	M

Common Name[1]	Scientific Name	Occurrence Potential[2]	Wildlife Section[3]
Buff-breasted Sandpiper	*Tryngites subruficollis*	t	SWB
Bufflehead	*Bucephala albeola*	B	SWB
Bullock's Oriole	*Icterus bullockii*	B	M
Canada Goose	*Branta canadensis*	B	SWB
Canvasback	*Aythya valisineria*	B	SWB
Cape May Warbler	*Dendroica tigrina*	t	M
Cassin's Finch	*Carpodacus cassinii*	W	M
Cedar Waxwing	*Bombycilla cedrorum*	B	M
Chestnut-collared Longspur*	*Calcarius ornatus*	B	M
Chimney Swift	*Chaetura pelagica*	B	M
Chipping Sparrow	*Spizella passerina*	B	M
Cinnamon Teal	*Anas cyanoptera*	B	SWB
Clark's Grebe	*Aechmophorus clarkii*	B	SWB
Clay-colored Sparrow	*Spizella pallida*	B	M
Cliff Swallow	*Petrochelidon pyrrhonota*	B	M
Common Goldeneye	*Bucephala clangula*	B	SWB
Common Grackle	*Quiscalus quiscula*	B	M
Common Loon*	*Gavia immer*	B	SWB
Common Merganser	*Mergus merganser*	t	SWB
Common Nighthawk	*Chordeiles minor*	B	M
Common Redpoll	*Carduelis flammea*	t	M
Common Yellowthroat	*Geothlypis trichas*	B	M
Dark-eyed Junco	*Junco hyemalis*	t	M
Downy Woodpecker	*Picoides pubescens*	B	M
Dunlin	*Calidris alpina*	t	SWB
Eastern Kingbird	*Tyrannus tyrannus*	B	M
Eurasian Collared-Dove	*Streptopelia decaota*	t	M
Eurasian Wigeon	*Anas penelope*	t	SWB
European Starling	*Sturnus vulgaris*	B	M
Evening Grosbeak	*Coccothraustes vespertinus*	t	M
Fox Sparrow	*Passerella iliaca*	t	M
Gadwall	*Anas strepera*	B	SWB
Garganey	*Anas querquedula*	t	SWB
Golden-crowned Kinglet	*Regulus satrapa*	t	M
Golden-crowned Sparrow	*Zonotrichia atricapilla*	t	M
Grasshopper Sparrow*	*Ammodramus savannarum*	B	M
Gray Catbird	*Dumetella carolinensis*	b	M
Gray-cheeked Thrush	*Catharus minimus*	t	M
Gray-crowned Rosy-Finch*	*Leucosticte tephrocotis*	W	M
Great-tailed Grackle	*Quiscalus mexicanus*	b	M
Greater Scaup	*Aythya marila*	t	SWB
Greater White-fronted Goose	*Anser albifrons*	t	SWB
Greater Yellowlegs	*Tringa melanoleuca*	t	SWB

Common Name[1]	Scientific Name	Occurrence Potential[2]	Wildlife Section[3]
Green Heron	*Butorides virescens*	t	SWB
Green-winged Teal	*Anas crecca*	B	SWB
Hairy Woodpecker	*Picoides villosus*	B	M
Harlequin Duck*	*Histrionicus histrionicus*	t	SWB
Harris' Sparrow	*Zonotrichia querula*	W	M
Hermit Thrush	*Catharus guttatus*	t	M
Hoary Redpoll	*Carduelis hornemanni*	t	M
Hooded Merganser	*Lophodytes cucullatus*	b	SWB
Horned Grebe	*Podiceps auritus*	B	SWB
Horned Lark	*Eremophila alpestris*	B	M
House Finch	*Carpodacus mexicanus*	B	M
House Sparrow	*Passer domesticus*	B	M
House Wren	*Troglodytes aedon*	B	M
Hudsonian Godwit	*Limosa haemastica*	t	SWB
Killdeer	*Charadrius vociferus*	B	SWB
Lapland Longspur	*Calcarius lapponicus*	t	M
Lark Bunting*	*Calamospiza melanocorys*	B	M
Lark Sparrow	*Chondestes grammacus*	B	M
Lazuli Bunting	*Passerina amoena*	b	M
Le Conte's Sparrow*	*Ammodramus leconteii*	t	M
Least Flycatcher	*Empidonax minimus*	B	M
Least Sandpiper	*Calidris minutilla*	t	SWB
Lesser Scaup	*Aythya affinis*	B	SWB
Lesser Yellowlegs	*Tringa flavipes*	t	SWB
Lincoln's Sparrow	*Melospiza lincolnii*	t	M
Loggerhead Shrike*	*Lanius ludovicianus*	B	M
Long-billed Curlew*	*Numenius americanus*	B	SWB
Long-billed Dowitcher	*Limnodromus scolopaceus*	t	SWB
Long-tailed Duck	*Clangula hyemalis*	t	SWB
McGillivray's Warbler	*Oporornis tolmiei*	t	M
Magnolia Warbler	*Dendroica magnolia*	t	M
Mallard	*Anas platyrhynchos*	B	SWB
Marbled Godwit	*Limosa fedoa*	B	SWB
Marsh Wren	*Cistothorus palustris*	B	M
McCown's Longspur*	*Calcarius mccownii*	B	M
Mountain Bluebird	*Sialia currucoides*	t	M
Mountain Chickadee	*Poecile gambeli*	W	M
Mountain Plover*	*Charadrius montanus*	B	SWB
Mourning Dove	*Zenaida macroura*	B	M
Mourning Warbler	*Oporornis philadelphia*	t	M
Nelson's Sharp-tailed Sparrow*	*Ammodramus nelsoni*	t	M
Northern Flicker	*Colaptes auratus*	B	M
Northern Mockingbird	*Mimus polyglottos*	t	M

Common Name[1]	Scientific Name	Occurrence Potential[2]	Wildlife Section[3]
Northern Pintail	*Anas acuta*	B	SWB
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	B	M
Northern Shoveler	*Anas clypeata*	B	SWB
Northern Shrike	*Lanius excubitor*	t	M
Northern Waterthrush	*Seiurus noveboracensis*	t	M
Oldsquaw	*Clangula hyemalis*	t	SWB
Olive-sided Flycatcher*	*Contopus cooperi*	t	M
Orange-crowned Warbler	*Vermivora celata*	t	M
Orchard Oriole	*Icterus spurius*	b	M
Ovenbird	*Seiurus aurocapillus*	t	M
Palm Warbler	*Dendroica palmarum*	t	M
Pectoral Sandpiper	*Calidris melanotos*	t	SWB
Pied-billed Grebe	*Podilymbus podiceps*	B	SWB
Pine Grosbeak	*Pinicola enucleator*	t	M
Pine Siskin	*Carduelis pinus*	t	M
Piping Plover*	*Charadrius melodus*	B	SWB
Purple Finch	*Carpodacus purpureus*	t	M
Purple Martin	*Progne subis*	t	M
Red Crossbill	*Loxia curvirostra*	t	M
Red Knot	*Calidris canutus*	t	SWB
Red Phalarope	*Phalaropus fulicaria*	t	SWB
Red-breasted Merganser	*Mergus serrator*	t	SWB
Red-breasted Nuthatch	*Sitta canadensis*	t	M
Red-eyed Vireo	*Vireo olivaceus*	t	M
Red-headed Woodpecker*	*Melanerpes erythrocephalus*	B	M
Red-necked Grebe	*Podiceps grisegena*	t	SWB
Red-necked Phalarope	*Phalaropus lobatus*	t	SWB
Red-winged Blackbird	*Agelaius phoeniceus*	B	M
Redhead	*Aythya americana*	B	SWB
Ring-necked Duck	*Aythya collaris*	t	SWB
Rock Dove	*Columba livia*	t	M
Rock Wren	*Salpinctes obsoletus*	b	M
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	t	M
Ross' Goose	*Chen rossii*	t	SWB
Ruby-crowned Kinglet	*Regulus calendula*	t	M
Ruby-throated Hummingbird	*Archilochus colubris*	B	M
Ruddy Duck	*Oxyura jamaicensis*	B	SWB
Ruddy Turnstone	*Arenaria interpres*	t	SWB
Rusty Blackbird	*Euphagus carolinus*	t	M
Sage Thrasher*	*Oreoscoptes montanus*	b	M
Sanderling	*Calidris alba*	t	SWB
Sandhill Crane	*Grus canadensis*	B	SWB
Savannah Sparrow	*Passerculus sandwichensis*	B	M

Common Name[1]	Scientific Name	Occurrence Potential[2]	Wildlife Section[3]
Say's Phoebe	*Sayornis saya*	B	M
Scarlet Tanager	*Piranga olivacea*	t	M
Scissor-tailed Flycatcher	*Tyrannus forficatus*	t	M
Sedge Wren*	*Cistothorus platensis*	t	M
Semipalmated Plover	*Charadrius semipalmatus*	t	SWB
Semipalmated Sandpiper	*Calidris pusilla*	t	SWB
Short-billed Dowitcher	*Limnodromus griseus*	t	SWB
Smith's Longspur	*Calcarius pictus*	t	M
Snow Bunting	*Plectrophenax nivalis*	t	M
Snow Goose	*Chen caerulescens*	t	SWB
Snowy Plover	*Charadrius alexandrinus*	t	SWB
Solitary Sandpiper	*Tringa solitaria*	t	SWB
Song Sparrow	*Melospiza melodia*	B	M
Sora	*Porzana carolina*	B	SWB
Spotted Sandpiper	*Actitis macularia*	B	SWB
Spotted Towhee	*Pipilo maculatus*	B	M
Sprague's Pipit*	*Anthus spragueii*	B	M
Stilt Sandpiper	*Calidris himantopus*	t	SWB
Surf Scoter	*Melanitta perspicillata*	t	SWB
Swainson's Thrush	*Catharus ustulatus*	t	M
Tennessee Warbler	*Vermivora peregrina*	t	M
Townsend's Solitaire	*Myadestes townsendi*	t	M
Townsend's Warbler	*Dendroica townsendi*	t	M
Tree Swallow	*Tachycineta bicolor*	B	M
Tundra Swan	*Cygnus columbianus*	t	SWB
Upland Sandpiper	*Bartramia longicauda*	B	SWB
Varied Thrush	*Ixoreus naevius*	t	M
Veery	*Catharus fuscescens*	t	M
Vesper Sparrow	*Pooecetes gramineus*	B	M
Virginia Rail	*Rallus limicola*	B	SWB
Warbling Vireo	*Vireo gilvus*	b	M
Western Grebe	*Aechmophorus occidentalis*	B	SWB
Western Kingbird	*Tyrannus verticalis*	B	M
Western Meadowlark	*Sturnella neglecta*	B	M
Western Sandpiper	*Calidris mauri*	t	SWB
Western Tanager	*Piranga ludoviciana*	B	M
Western Wood-pewee	*Contopus sordidulus*	B	M
Whimbrel	*Numenius phaeopus*	t	SWB
White-crowned Sparrow	*Zonotrichia leucophrys*	t	M
White-rumped Sandpiper	*Calidris fuscicollis*	t	SWB
White-throated Sparrow	*Zonotrichia albicollis*	t	M
White-winged Dove	*Zenaida asiatica*	t	M
White-winged Scoter	*Melanitta fusca*	t	SWB

Common Name[1]	Scientific Name	Occurrence Potential[2]	Wildlife Section[3]
Whooping Crane*	*Grus americana*	t	SWB
Willet	*Catoptrophorus semipalmatus*	B	SWB
Willow Flycatcher	*Empidonax traillii*	B	M
Wilson's Phalarope	*Phalaropus tricolor*	B	SWB
Wilson's Snipe	*Gallinago delicata*	B	SWB
Wilson's Warbler	*Wilsonia pusilla*	t	M
Winter Wren	*Troglodytes troglodytes*	t	M
Wood Duck	*Aix sponsa*	B	SWB
Wood Thrush	*Hylocichla mustelina*	t	M
Yellow Rail*	*Coturnicops noveboracensis*	t	SWB
Yellow Warbler	*Dendroica petechia*	B	M
Yellow-billed Cuckoo*	*Coccyzus americanus*	t	M
Yellow-bellied Sapsucker	*Sphyrapicus varius*	t	M
Yellow-breasted Chat	*Icteria virens*	t	M
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	B	M
Yellow-rumped Warbler	*Dendroica coronata*	t	M

[1] Special status species indicated by asterisk.
[2] Occurrence potential of bird species includes: direct evidence of breeding (B), indirect evidence of breeding (b), over-wintering (W), and known transient or migrant (t) in the 1 degree grid block covering 48 N and 49 N latitude and 107 W and 108 W longitude (USFWS 1999, MDBB 2006*a*, MDBB 2006*b*).
[3] Pertinent Environmental Assessment wildlife sections include: 3.11.1.8, Shorebirds and Other Waterbirds (SWB) and 3.11.1.9, Migratory Birds (M).

APPENDIX C

Hazardous Materials Management Summary

Hazardous Materials Management Summary

This table includes the types and quantities of hazardous and extremely hazardous materials that may be expected to be used, stored, transported or disposed within the BNGPA

Materials	Hazardous Substances	CAS #	RCRA #	Reportable Quantity
Air Foam				
	2-Butoxyethanol	111-76-2	~~	~~
	Ethylene Glycol	107-21-1	~~	5000Lbs
Alcomer 120L				
	Mineral Oil	64742-52-5	~~	~~
	Petroleum Solvent	8032-32-4	~~	~~
	Proprietary Surfactants	Proprietary	~~	~~
ARMCO Products				
	Grease	64742-52-5	~~	~~
	Oil	64741-53-5	~~	~~
	Graphite	7782-42-5	~~	~~
	Lamp Black	7440-44-0	~~	~~
	Lead	7439-92-1	~~	10Lbs
	Talc	14807-96-6	~~	~~
Collar Dope				
	Grease	64742-53-5	~~	~~
	Oil	64742-53-5	~~	~~
	Lead	7439-92-1	~~	~~
	Talc	14807-96-6	~~	~~
	Graphite	7782-42-5	~~	~~
	Carbon Black	1333-86-4	~~	~~
Zinc				
	Grease	64742-53-5	~~	~~
	Oil	64742-52-5	~~	~~
	Talc	14807-96-6	~~	~~
	Lime	1305-78-8	~~	~~
	Zinc	7440-66-6	~~	~~
BA-2 Buffering Agent				
	Sulfamic Acid	5329-14-6	~~	~~
Bachman KCl-1				
	Organic Acid Salt Solution (no known Hazardous Ingredients)	~~	~~	~~
BE-6 Microbiocide				
	2-Bromo-2nitro-1,3-propanediol	52-51-7	~~	~~
Refined Bleached and Deodorized Canola Oil				
	No known Hazards	~~	~~	~~
CF II Drilling Mud Thinner powder				
	Lignin Not listed	~~	~~	~~
CLA-STA XP Additive				
	Polyepichlorohydrin, trimethyl amine quaternized	51838-31-4	~~	~~
	Trimethylamine, N-oxide	1184-78-7	~~	100Lbs
CLAYFIX-II Material				
	Alkylated quaternary chloride	~~	~~	~~

Materials	Hazardous Substances	CAS #	RCRA #	Reportable Quantity
Cotton Seed Hulls	Cotton dust (raw)	~~	~~	~~
	Particulates Not Otherwise Classified (PNOC)	~~	~~	~~
D-D				
	Proprietary Ingredients	~~	~~	~~
	Isopropyl alcohol	67-63-0	~~	~~
Drilling Paper				
	Particulates Not Otherwise Classified (PNOC)	~~	~~	~~
DRISPAC® Polymer (regular, XT and Superlo®				
	Does not meet the definition of a hazardous material CFR 1910.1200 (OSHA)	~~	~~	~~
FA-1 or Van Foam				
	Ethanol	64-17-5	~~	~~
	Poly (oxy-1-2-ethanediyl), alpha-sulfo-omega-hydroxy, C6-10-alkyl, ethers, ammonium salts	68037-05-8	~~	~~
	Alcohols, c6-10 ethoxylated	68439-45-2	~~	~~
FSF Polyswell				
	Proprietary Ingredients	~~	~~	~~
GBW-30 Breaker				
	Cellulose enzyme	~~	~~	~~
Gel				
	Bentonite Clay	11302-78-9	~~	~~
Hydrated Lime				
	Calcium Oxide	1305-62-0	~~	~~
Lignite				
	Leonardite	1415-93-6	~~	~~
Liquik 2 NU RLU - Drilling Detergent				
	LIQUIK 2 NU RLU	~~	~~	~~
Max Gel				
	Bentonite	1302-78-9	~~	~~
	Silica, crystalline, quarts	14808-60-7	~~	~~
	Silica, crystalline, Tridymite	15468-32-3	~~	~~
	Gypsum	13397-24-5	~~	~~
Maxi-Seal				
	No Hazardous Ingredients	~~	~~	~~
MO-67				
	Sodium hydroxide	1310-73-2	~~	1000Lbs
PELS (R) Caustic Soda Beads				
	Sodium hydroxide	1310-73-2	~~	1000Lbs
	Water	7732-18-5		
Polypac ®				
	Carboxymethylcellulose sodium salt	9004-32-4	~~	~~
Polypac UL ®				
	Carboxymethylcellulose sodium salt	9004-32-4	~~	~~
Poly-Plus (liquid)				
	Petroleum distillates, hydrotreated light Anionic polyacrylamide	64742-47-8	~~	~~

Materials	Hazardous Substances	CAS #	RCRA #	Reportable Quantity
Rod Coat B				
	Barium Tallow Fatty Acid Complex	68201-19-4	~~	~~
	Mineral Oil, Petroleum distillates, hydrotreated heavy naphthenic compounds	64742-52-5	~~	~~
Rod Ease				
	Vegetable Oil	~~	~~	~~
	Additives	~~	~~	~~
S.A.P.P.				
	Sodium Acid Pyrophosphate	7758-16-9	~~	~~
SAND-BRADY				
	Crystalline silica, quartz	14808-60-7	~~	~~
Soda Ash				
	Sodium Carbonate	497-19-8	~~	~~
Sodium bicarbonate				
	baking soda	144-55-8	~~	~~
SSO-21M Winterized				
	Ethoxylated nonylphenol	~~	~~	~~
	Ethylene glycol monobutyl ether	111-76-2	~~	~~
	Methanol	67-56-1	U154	5000Lbs
Tetra sodium Pyrophosphate				
	Tetra sodium Pyrophosphate, anhydrous	7722-88-5	~~	~~
VIS-Cease				
	Petroleum distillates: (Hydro-treated Light)	~~	~~	~~

APPENDIX D

Reclamation Plan

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1.0 INTRODUCTION

This document establishes construction, erosion control, interim reclamation, final reclamation and monitoring procedures for the Bowdoin Natural Gas Development Project Area (BNGPA). These procedures are designed to facilitate successful reclamation of the area. The procedures were developed using the "Fieldwide Drilling Operations Plan for Drilling and Surface Use for All Fields/Units/Leases (Federal) in Phillips County and All Fields/Units/Leases (Federal) West of Hinsdale in Valley County" and "Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, The Gold Book" (BLM 2006).

The BNGPA is under the management of the Bureau of Land Management (BLM) Malta Field Office. Any Operator wishing to deviate from the guidelines set forth in this document shall receive prior approval from the Great Falls Oil and Gas Field Station and Malta Field Office. In this document, use of the terms *shall* or *will* denote practices that are required by BLM to be completed by the Operator. Use of the term *should* denotes practices that are recommended by BLM to be completed by the Operator.

Possible disturbed areas include drill pads, access roads, pipelines, compressor sites, and other ancillary areas used during development. The reclamation procedures presented are designed to be completed either concurrently with, or at the cessation of, construction and production activities. The procedures will serve to minimize the impact of activities in the BNGPA on natural resources and facilitate successful reclamation of disturbed areas to approximate pre-disturbance conditions.

Erosion control is a major part of the reclamation plan as it is a continuous process from disturbance through final reclamation. Erosion control measures outlined in this document will be used to stabilize disturbed sites and reduce erosion, runoff and sedimentation in the entire BNGPA throughout the life of the project.

Interim reclamation will be completed on all areas where final reclamation procedures cannot be promptly implemented to minimize the footprint of disturbance. Interim reclamation measures include recontouring, respreading topsoil, and seeding and/or implementation of erosion and weed control measures.

Final reclamation measures will be implemented when all disturbance and use of an area are finished. Final reclamation will serve to return the area to the approximate pre-disturbance condition and set the course for eventual ecosystem restoration. Final reclamation procedures include all of the steps involved in recontouring, respreading topsoil, seeding, and ensuring natural vegetation establishment, such as ripping, erosion and weed control, and grazing deferment.

The last step in this reclamation plan is the monitoring and maintenance of final reclamation. This will include observing and measuring the success of final reclamation efforts, and determining if further reclamation efforts are needed.

2.0 OBJECTIVES

Natural-gas development is one of many uses of public lands and resources. While development may have a short- or long-term effect on the land, successful reclamation can ensure the effect is not permanent. The reclamation process involves restoring the original landform or creating a landform that approximates and blends in with the surrounding landform.

The objectives of reclamation during and after development of the BNGPA are to return the land to safe and predisturbed conditions, consistent with the establishment of productive post-development uses. The designated post-development uses for the project area are defined as wildlife habitat, livestock production, farming, recreational use, and ongoing operation of natural gas production activities.

This plan has been developed to meet the following objectives for interim reclamation during active operations and final reclamation of roadways, pipelines, compressor stations, drill locations, and ancillary facilities:

- During the life of the development, all disturbed areas not needed for active support of production operations will undergo interim reclamation in order to minimize the environmental impacts of development on other resources and uses.
- At final abandonment, well locations, production facilities, and access roads will undergo final reclamation so that the character and productivity of the land and water are restored (BLM 2006).
- Establishment of long-term, self-sustaining vegetation communities by reseeding with native plants and promoting natural re-establishment and succession;
- Protection of surface water quality including compliance with all applicable water quality standards and storm water management requirements;
- Minimization of post-reclamation visual contacts with surrounding areas to the extent practical; and
- Minimization of long-term closure requirements, especially for ongoing care and maintenance.

These objectives shall be considered during all phases of reclamation including construction, interim reclamation, and final reclamation.

3.0 PERFORMANCE STANDARDS

Reclamation success will be evaluated using defined performance standards. Interim reclamation success will be measured by the following standards:

- Erosion control methods shall be in place to mitigate any highly erosive features, such as rills, gullies, or sheet erosion.

In rangeland areas:

The following criteria refer to desirable species. Desirable species are those species present in the seed mix of the surrounding undisturbed natural vegetation. Within two to three growing seasons of the initial seeding, a short-term evaluation of revegetation success should be completed to determine if the standards are met.

- Vegetative cover, measured as canopy cover using a BLM approved method, will be at least 50 percent of adjacent undisturbed area cover (BLM approved methods can be found in BLM (1996));
- Desirable species will comprise 85 percent of the total vegetative cover of the revegetated area;
- No single species will account for more than 50 percent of the total vegetative cover unless it comprises more than 50 percent of the vegetative cover on adjacent undisturbed areas;

In farmland areas:

- Crop production will be 85 percent of that in adjacent crop areas;
- Desirable species will comprise 85 percent of the species present.

If these standards are not met, additional reclamation measures such as reseeding, fencing, fertilizing or erosion control shall be implemented. When the short-term standards are not met, the likelihood of achieving the final reclamation standards presented below is very low unless mitigating measures are taken.

Final reclamation success will be measured by the following standards:

- Erosion susceptibility of the site shall be equal to or less than the reference site, i.e., no erosive features shall be present on the revegetated sites that are not also prevalent in the adjacent undisturbed areas.

In rangeland areas:

- Vegetative cover will be at least 80 percent of adjacent undisturbed area cover; or, potential vegetative cover is as defined in the NRCS Ecological Site guides for the area;
- Desirable species will comprise 90 percent of the revegetated area;
- No single species will account for more than 35 percent of the total vegetative cover unless it comprises more than 35 percent of the vegetative cover on adjacent undisturbed areas;
- No category 1, 2, or 3 invasive and non-native species will be present;

In farmland areas:

- Crop production will be 95 percent of that in adjacent crop areas;

- Desirable species will comprise 90 percent of the species present;
- No category 1, 2, or 3 invasive and non-native species will be present;
- The integrity of sub-irrigation, where present, will be re-established, i.e., disturbed sites will be returned to their original surface elevation, and fill will be of equal textural class of surrounding undisturbed areas.

4.0 PLANNING AND VEGETATION AND SOIL INVENTORIES

4.1 PLANNING

Reclamation planning should be completed to define the scope for interim and final reclamation activities. Characterization of soil resources and vegetation reference sites should be completed to develop the reclamation and stabilization work plan. Physical and chemical soil characterization should be completed to support development of certified weed-free seed mixtures, soil amendments, and fertilizer requirements. Vegetation reference sites should be identified to evaluate reclamation success.

Planning should consider the timing between initial construction and final reclamation for abandonment. The extent of stabilization and interim reclamation practices should be appropriate for the site conditions with respect to the duration between construction and final reclamation activities. When a short duration will occur before final reclamation, stabilization practices should focus on erosion and weed control.

The availability of topsoil for final reclamation shall be considered prior to construction. Topsoil shall be respread during interim reclamation; however, topsoil deficiencies at the time of final reclamation may result. Salvage of topsoil used for interim reclamation may result in a decrease in the overall quality and quantity of topsoil available for final reclamation. The suitability of seeding and establishing vegetation in subsoil should be considered for interim reclamation.

4.2 VEGETATION

An adjacent undisturbed area reference site should be identified for each area to be or already disturbed. Each area marked for disturbance should be observed, and a representative reference site with similar aspect, soils, growing conditions, and vegetation cover identified. This undisturbed site should be used as a comparison for the revegetated area whenever any vegetation data is collected. Typical reference sites may be used for numerous locations having similar conditions. If a suitable reference site is not available, the site should be matched to the appropriate NRCS Ecological Site.

4.3 SOIL RESOURCE INVENTORY

Prior to disturbance, soil samples may be required to be collected in the areas to be disturbed. The soil samples should be analyzed at a soil testing laboratory to determine the texture and any limiting factors of the soil. The factors tested may include pH, lime, salts, sodium adsorption ratio (SAR), and soil nutrient availability. From these tests, those factors that may inhibit revegetation can be identified. This soil testing can be used to determine the depth of topsoil to

be salvaged as well as rates and composition of any required soil amendments and fertilizers. The soil testing results would also aid in the prescription of the seed mix.

5.0 CONSTRUCTION

Drill pads, access roads, and pipelines will be designed and constructed to reduce erosion susceptibility and impacts to the landscape. Wetlands, areas with low reclamation potential, and important wildlife habitat areas should be avoided to the maximum extent possible.

5.1 TOPSOIL SALVAGE

To facilitate successful reclamation, topsoil salvage shall be completed on every area where the soil will be disturbed. Topsoil salvage entails removing suitable topsoil and handling and storing it separately from the subsoil. When final reclamation begins on a site, the topsoil will be applied as the top layer to provide the best medium for plant growth.

It is recommended that an average of four to six inches of topsoil be removed and stockpiled from each location prior to any construction. This depth may be modified based on conditions indicated during the soils resource inventory. Piling subsurface soil on top of topsoil shall be prohibited.

Soil disturbance during construction should be kept at a minimum. The surface should be minimally graded or cleared on drill pads which require less than one foot of cut and fill. Where possible, disturbance will be limited to the topping of shrubs and grasses. Grading should only be used when surface conditions are unsafe for drilling and completion equipment/vehicles. When grading is needed, topsoil will be windrowed along one side of the modified area and kept separate from the trench soil.

It is suggested that for sites with poor reclamation potential and sites that have severe erosion hazards, soil mapping be completed to identify representative soil groups, so that the best available topsoil can be removed and stockpiled to facilitate reclamation. Soil samples can then be obtained to characterize each soil group, and the samples analyzed for limiting factors such as salinity and percent rock content. The best depths and areas for topsoil salvage can be determined from the data. For example, one site may have four inches of topsoil and another may have 12 inches of topsoil.

6.0 EROSION CONTROL

Erosion control is a continuous process that is completed by the Operator from construction through production and interim and final reclamation. Every disturbed area will be evaluated for erosion susceptibility and appropriate erosion control measures implemented when needed. The erosion control process will continue until the disturbed site has met final reclamation standards.

It is suggested that a science-based method to measure erosion susceptibility be used. The Erosion Condition Classification System (Clark, 1980) is one such widely accepted method. This system gives values to erosion features such as rills, pedestals, and surface litter to determine a soil surface factor and the associated erosion condition class. These condition classes range

from stable to severe. Based on the condition class, it can be determined if erosion control is necessary, and if so, the type of control measure to be implemented.

Construction storm water discharge for oil and gas production is regulated under the Montana Pollution Discharge Elimination System (MPDES) Permit No. MTR 100000. Authorization for storm water discharge is required for disturbance areas exceeding one acre in size and for areas less than one acre in size but part of a larger (greater than one acre) common plan of development. Permits may be obtained for combined activities that may include numerous well locations, roads, pipelines, and other facilitates being constructed within a common plan of development. Specific rules applicable for storm water related to construction activities are included in the Montana Water Quality Act, Title 75, Chapter 5, Montana Code Annotated (MCA) and the Federal Water Pollution Control Act (the "Clean Water Act"), 33 U.S.C. §1251.

All runoff and erosion control structures will be inspected on a regular schedule and after major runoff events. During inspection, the control structures will be cleaned out and maintained in functional condition. The inspection and maintenance schedule will be conducted throughout the duration of construction, drilling, production and final reclamation until successful revegetation and soil stability is attained.

Often a combination of temporary and permanent techniques is needed to adequately control sediment and erosion. The erosion-control method used shall be based on each site's stability characteristics and the duration required for erosion control. Several small structures may function more effectively than a single large structure. Measures useful during construction include straw mulch, straw wattles, and silt fence barriers. During interim reclamation, temporary seeding, straw mulch, erosion mats, berms, and water bars are often effective. For final reclamation, slope recontouring, straw mulch, and permanent seeding are often used.

6.1 STRAW MULCH

Certified weed-free straw mulch application may be required on disturbed soils to provide temporary protection until permanent vegetation is established. Mulch application aids in preventing wind and water erosion and enhances plant establishment by retaining soil moisture and creating micro-habitats for seedling development. Following fertilizer application, if necessary, and seeding, mulch shall be applied at 1.5-2.0 tons per acre. Mulch should not be applied in the presence of free surface water, but may be applied upon damp ground. Mulch should not be applied to areas having substantial vegetative growth, such as grasses, weeds, and grains. Mulching shall not be performed during adverse weather conditions or when wind prevents uniform distribution. Application shall be in a manner that does not seriously disturb the seedbed surface.

Mulch shall be crimped into the soil using a disk crimper to prevent wind loss. The desired depth for crimping is three inches. Following crimping, the straw mulch should resemble stubble in a harvested wheat field.

6.2 STRAW WATTLES

Certified weed-free straw wattles may be placed on erosion-prone sites with the objective of preventing rill and gully development and capturing sediment. Straw wattles are burlap tubes filled with weed-free rice straw, varying in length and diameter. By placing several wattles

perpendicular to the direction of water flow, surface runoff and sediment loss can be reduced in areas with steep slopes. The lifespan for burlap straw wattles ranges from one to five years, depending on placement and weather. Following placement, straw wattles shall be monitored and replaced as necessary until site stability is achieved.

6.3 SILT FENCES

A silt fence is a barrier of geotextile fabric, or filter cloth, used to temporarily intercept sediment-laden runoff from small drainage areas. A silt fence can be used to promote sheet flow, to reduce runoff velocity, and to help retain transported sediment on the site, thus reducing erosion and enhancing water quality. Silt fences are very effective in sheet flow conditions and usually ineffective with concentrated flows. Silt fences are commonly placed at the bottom of a disturbed slope or adjacent to streams and ponds. They can be used for slope protection, in minor swales or ditches, and around storm drains. Silt fences are most effective when areas draining to the barrier are 2.5 acres or less. Silt fences should not be used where concentrated flows exceed 1cfs (Roberts, 1995) or where rocky soils prevent the full and uniform anchoring of the fence toe.

Life expectancy of a silt fence is dependent on the ultraviolet stability and type of fabric, but is usually six months to several years. Woven and nonwoven synthetic fabrics are available. Woven fabric is generally stronger than nonwoven fabric and usually does not require the additional support of a wire mesh.

6.4 EROSION MATS

Mats are used to prevent erosion on steep slopes or critical areas and to provide a stable seedbed for one or more growing seasons. The mat is laid parallel to the slope and staked down following contouring and seeding operations. Because numerous erosion control mat materials exist, the mat materials shall be installed according to the manufacturer's instructions.

6.5 BERMS

Berms are used to control surface runoff at well sites. Berms are typically 18 inches high and are constructed around the fill portion of well sites to control and contain all surface runoff and/or fuel or petroleum product spills on the pad surface.

6.6 WATER BARS

Water bars are used to divert water from an erosion-prone site to a vegetated and more stable area. A water bar consists of a trench and adjoining down slope embankment. Water bars should be constructed approximately one to two feet deep. Water bars are placed perpendicular to side slopes at appropriate intervals based on the slope gradient. The bars shall begin and end in undisturbed soils and be constructed generally parallel to the slope contour with a slight grade to facilitate water runoff.

Linear disturbances such as newly constructed or reclaimed pipelines or roads should be cross-drained by water bars. Any slope over 3:1 in steepness should have water bars installed to

reduce the slope length. Water bars should be constructed in soils that normally do not support adequate vegetation to prevent erosion, or other sites at risk to excessive erosion.

7.0 INTERIM RECLAMATION

The intent of interim reclamation is to minimize the environmental impacts of the development on other resources and uses during the period between construction and final reclamation. Upon completion of construction, interim reclamation shall be completed in areas where final reclamation will not occur at the completion of construction. In locations that will not require recontouring and interim reclamation, final reclamation shall be completed at the end of construction as described in Section 8. Reclamation operations shall be conducted on all disturbed lands in accordance with MBOGC requirements and surface owner agreements.

7.1 STABILIZATION AND RECONTOURING

Unused areas around well pads, unused pits, flowlines, pipelines, power lines to wells, cut-and-fill slopes of roads, and any other surfaces not required for field use will be graded to form stable, rounded slopes that blend with the natural terrain. Erosion control structures and/or sediment containment systems will be built or installed as needed, the areas will be ripped, and temporary seeding completed. Seeding will occur within three months of completing construction or during the next seeding window, whichever occurs first.

7.2 NOXIOUS WEED CONTROL

Noxious weeds will be controlled on disturbed areas in accordance with guidelines established by the EPA, BLM, State, and local pesticide authorities. Only BLM-approved chemicals will be used on public lands. Appropriate measures, chemical, biological or mechanical, will be followed to prevent the spread of weed infestations and reduce potential for spreading weed seed via equipment use. This may include, but not be limited to, washing rig frames and all drilling equipment prior to entry onto public lands.

8.0 FINAL RECLAMATION

8.1 RECONTOURING

All disturbed areas shall be graded to the approximate original contour or to blend with surrounding topography. In preparation for revegetation, extensive earthwork should be completed to help the location blend in with the adjacent rangeland.

Sites that have been recontoured and stabilized by revegetation and erosion control during the production phase may not need recontouring during final reclamation. Sites with revegetated and bare areas that already closely resemble the approximate original contour do not need to be recontoured. Also, if the disturbed area has stabilized and if restoring the original contour will cause additional disturbance, then recontouring may not be required.

Prior to recontouring, all wells will be completely plugged in accordance with the standards stated in the Conditions of Approval for the Notice of Intent to Abandon (NIA), all pipelines will be purged of all fluids as necessary, and the fluids will be disposed of in the proper manner. The topsoil and vegetative material will be scraped from cut-and-fill slopes of roads and pads where stable vegetation has occurred and stockpiled for final distribution after the area is recontoured. This is done so that topsoil that has been previously placed on pad edges or backslopes of roads will not be buried. Additional stockpiled topsoil is preferred for final cover.

Before well locations are recontoured, oily surface material, cuttings (provided they are not regulated under RCRA, CERCLA, or other applicable regulations), and severely compacted soils should be worked and broken into aggregates of one inch in diameter or smaller. If oily surface materials or cuttings are present, to facilitate the breakdown of the hydrocarbons, the broken soil aggregates should be treated with a nitrogen source to adjust the carbon to nitrogen ratio of the soil. The soil should be sampled and analyzed in a laboratory to determine the correct carbon to nitrogen ratio. This should occur before available topsoil and vegetation is spread on the surface for seed bed preparation.

Drainages will be reclaimed to approximate the original bank configuration, stream bottom width, and channel gradient. Any pilings, debris, or other obstructions will be removed from the drainage channels.

Burn pits, reserve pits, and any other pits that are no longer needed will be filled and leveled or sloped to resemble adjacent terrain. Cuttings and drilling mud will be allowed to dry and then all contents including liners will be covered and regraded to provide surface drainage from the filled area. Pit closure should be completed in accordance with BLM requirements. The concentration of nonexempt hazardous substances in the pit at the time of backfilling should not exceed standards set forth in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), or as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). Hazardous substances removed from the sites shall be disposed of in accordance with applicable standards.

Once the site has been recontoured, the stockpiled topsoil shall be spread evenly over the entire disturbed area.

8.2 Seeding and Soil Amendments

8.2.1 Seedbed Preparation

Seedbed preparation is critical to the success of revegetation projects. Soils are often compacted due to travel by heavy equipment, creating a less-than-ideal substrate for germination. The objective of seedbed preparation is to reduce soil compaction and create a suitable seedbed for germination and plant growth.

Procedures for properly preparing the seedbed vary with each site and may include tilling, disking, and/or dragging. The objectives of reclamation are to re-establish a growing stand of vegetation similar to the adjacent undisturbed ground or as defined in the NRCS Ecological Site Guides. In all cases the following parameters will be achieved:

a. The certified weed-free seed will be covered with ¼ to ½ inch of soil.

b. The ground will be scarified to allow the seed to establish roots, protect the surface from wind erosion and maximize rain and snowfall retention.

8.2.2 Compaction Reduction

Prior to contouring and topsoil application, sites should be ripped between two and four inches below the bottom of a compacted layer to decrease compaction. Sites may also be disked and floated with chain harrows to further reduce compacted layers, break up large clods, roughen the surface to increase seed-soil contact and create safe germination sites.

8.2.3 Seeding

All disturbed areas will be seeded with a drill seeder or by broadcast seeding when access does not allow drill seeding. As much seeding as possible will be conducted during the fall before the ground freezes. Occasional seeding may occur in the spring as long as favorable conditions exist. Seeding will not be allowed in frozen or saturated soil conditions except for winter seeding of sagebrush on snow. Reseeding will be required when a satisfactory stand is not obtained.

The seed mixture shall be planted in the amounts specified in pounds of pure live seed (PLS) per acre. There shall be no invasive or non-native weed seeds in the mixture. Seed shall be tested and the viability testing shall be done in accordance with Montana State law(s). Viability testing results should be available for BLM review, if requested. Commercial seed shall be either State-certified or registered weed-free seed. The seed mixture container shall be tagged in accordance with State law(s) and available for inspection. The amount of seed planted will be enough so that upon germination, the soil is adequately covered.

8.2.4 Seed Mixtures

All disturbed areas will be seeded with an approved seed mixture. An approved standard seed mixture is provided in Table 1, and other approved species that could be included in a customized mix for a particular site, along with recommended seeding rates for a pure stand, are provided in Table 2. Approved species will be used on all BLM surface land and on private surface unless the landowner requests otherwise. Non-native yellow sweetclover will not be allowed as a component of any seed mix. The vegetation inventory described in 3.0 and 4.2 would be used to develop the species composition for the seed mixes. Using species that are already present in an area increases the probability that the area will be revegetated successfully. Soil sampling may also be necessary to ensure that the species in the seed mix will establish on the site. After the vegetation survey and/or soil sampling has been completed, a mix should be developed using species listed in Table 2; no monocultures will be allowed. The mixture should be diverse enough to show a variety of native desirable plants upon germination. The percentage of each species in the mixture will determine the percentage of that species' pure-stand seeding rate used. Forbs and shrubs may be included in the seed mixtures; however, they should not be included when herbicides are used to control invasive weeds.

8.2.5 Fertilizer and Soil Amendments

Fertilizer or other supplemental treatments may be necessary to establish a growing stand of vegetation. The soils in each area should be tested to determine the amounts of plant-available nutrients and any limiting soil factors. Based on this sampling, fertilizer should be applied as needed after seeding. Any soil amendments needed to remediate limiting factors, such as sodic and saline soils, should also be applied to the site.

8.2.6 Mulch

Straw mulch application during final reclamation shall be completed as described above for erosion control (**Section 6.1**).

8.2.7 Grazing

When possible, grazing by livestock should be deferred from sites recently seeded. Heavy grazing can significantly hinder revegetation success. Site conditions and reclamation success should be reviewed prior to initiation of grazing. Grazing should be deferred for one to two growing seasons after seeding takes place or until plants are sufficiently established. This may require construction of fences around sensitive seeded areas.

8.2.8 Weed Control

Seeded and bare areas should be monitored for weed infestations. All category 1, 2, and 3 invasive and non-native species will be controlled and eradicated if possible. Appropriate measures—chemical, biological, or mechanical—will be followed to prevent the spread of weed infestations. Only BLM-approved chemicals will be used on public lands. As indicated above, it may be necessary to plant forbs and shrubs after grasses in order to control weeds. Weed growth following the disturbance of recontouring can be controlled with a broadleaf herbicide; forbs and shrubs can be planted once the weed population is sufficiently diminished. Natural re-establishment and succession of forbs and shrubs will occur from surrounding areas.

9.0 MONITORING AND MAINTENANCE

Reclamation should be monitored to evaluate the success of both interim and final reclamation efforts and determine if the techniques used are effective or if additional measures are needed.

Monitoring of interim reclamation is integral to managing storm water discharges authorized under MPDES. Monitoring of interim reclamation success should include visual observations and measurements of the soil stability and the effectiveness of any erosion-control measures implemented. If any temporary revegetation has taken place, seedling emergence and density should be measured to determine if it is sufficient.

Final reclamation monitoring will be used to determine the effectiveness of the reclamation methods implemented and, in the long-run, determine if an area meets final requirements for reclamation success. After final reclamation has taken place, erosion-control measures and revegetation efforts shall be observed for effectiveness. This should include measuring site stability and seedling emergence and density. Invasive and non-native weeds should also be closely monitored during this period so that measures to stop their spread can be implemented immediately upon infestation.

After sufficient time has passed for vegetation to become established, each disturbed area and corresponding reference area shall be monitored for final reclamation success. Data collected should include site stability and acceptable and repeatable methods of collecting vegetation cover, ground cover, plant density, and species composition. This data can then be used to determine if a site has met the final reclamation success goals listed in the objectives section of

this document. If sites do not meet these goals, additional reclamation efforts may be needed. However, below-average precipitation for an extended time may prevent a site from meeting the objectives. A site may need more time for vegetation to establish and not require additional reclamation.

Water bars that are no longer needed to control runoff should be flattened to blend with the surrounding landform and vegetation.

Table 1. Standard seed mixture for the BNGPA

Species	% of Mix	PLS lbs/acre
Western Wheatgrass	40	3.2
Blue Grama	10	0.2
Needle and Thread	20	1.2
Prairie Junegrass	25	0.25
Purple Prairie Clover	5	0.15
Total	100	

Table 2. BNGPA recommended species, cultivars, and pure stand seeding rates

Plant Species	Scientific Name	Recommended Cultivar[1]	Drill Seeding Rate[2,3] PLS lbs/acre[4]
Grasses			
Bluebunch Wheatgrass	*Pseudoroegneria spicata*	Goldar	6
Green Needlegrass	*Nassella viridula*	Lodorm	5
Sandberg Bluegrass	*Poa secunda*	High Plains	2
Prairie Junegrass	*Koeleria macrantha*	n/a	1
Blue Grama	*Bouteloua gracilis*	Bad River	2
Needle and Thread	*Hesperostipa comata*	n/a	6
Indian Ricegrass	*Achnatherum hymenoides*	Rimrock	6
Prairie Sandreed	*Calamovilfa longifolia*	Goshen	4
Inland Saltgrass	*Distichlis spicata*	n/a	5
Alkali Sacaton	*Sporobolus airoides*	n/a	1
Western Wheatgrass	*Pascopyrum smithii*	Rosana	8
Forbs			
Dotted Gayfeather	*Liatris punctata*	n/a	6.4
Western Yarrow	*Achillea millefolium*	Great Northern	0.5
Purple Prairie Clover *or* White Prairie Clover	*Dalea purpurea* *Dalea candida*	Bismark Antelope	3
Shrubs			
Fourwing Saltbush	*Atriplex canescens*	Wytana	0.5
Silver Buffaloberry	*Shepherdia argenta*	Sakakawea	0.5–1
Wyoming Big Sagebrush[6]	*Artemisia tridentata*	n/a	3
Silver Sagebrush[6]	*Artemisia cana*	n/a	2
Wood's Rose	*Rosa woodsii*	n/a	0.5–1
Winterfat[6]	*Krascheninnikovia lanata*	Open Range	<.5

1 Other cultivars adapted to the area are acceptable.
2 Seeding rates are given for 12-inch drill rows.
3 When broadcast seeding, double the pounds per acre seeded.
4 Pure Live Seed
5 Lewis Blue Flax should not be seeded in a mix at rates higher than 0.15 lbs/acre.
6 These shrubs should always be broadcast seeded; seeding rates listed are for broadcast seeding.

Sources: NRCS Montana Technical Note, Plant Materials MT-46 (Rev. 1);
NRCS Montana Technical Note, Range MT-33
Granite Seed Company, Lehi, UT

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