Data Adequacy Standards

For The

Powder River Coal Region

JANUARY 2016

BLM

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DATA ADEQUACY STANDARDS

for the

DECERTIFIED POWDER RIVER COAL REGION

Bureau of Land Management

Wyoming

DRAFT January 2016

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INTRODUCTION

The purpose of this document is to identify recommended levels of data to be acquired prior to the evaluation of lease applications in the Powder River Coal Region of Wyoming and Montana. A "data adequacy standard" provides the minimum quality and quantity of data needed for a particular resource to prepare documents that support coal leasing decisions. The Bureau of Land Management resource specialists and contractors need these standards in order to adequately inventory and analyze environmental issues associated with their respective resources in regards to coal development. The coal decision makers need these standards to help assure that their coal leasing decisions and recommendations have a solid data foundation.

Examples of documents/decisions where minimum data standards would be used include the following:

- Delineation of a tract of coal that is competitive and achieves maximum economic recovery of the coal resource;
- Determination of the amount of coal reserves available in the selected coal tract and alternatives;
- Proper assessment of site specific, regional, and cumulative resource impacts associated with the potential leasing action;
- Determination of the specific set of lease stipulations for a proposed lease tract.

The need for data adequacy standards was identified by the Office of Technology Assessment (OTA). In OTA's report in May 1984, *Environmental Protection in the Federal Coal Leasing Program*, data adequacy standards were recommended for all stages of the coal leasing process. In Secretary Clark's response to this OTA report dated July 1984, the Department concurred with the need for data adequacy standards. In March 1985, the Federal/State Coal Advisory Board in a public meeting discussed the need and scope of data adequacy standards. At that meeting, the Board recommended that the Regional Coal Team design data adequacy standards for their respective regions. During its public discussions on this item, the board reached a consensus that the Regional Coal Teams would focus on tract specific data adequacy standards rather than land use planning standards.

In June 1985, the Powder River Regional Coal Team (RCT) held a public discussion on a preparation plan for the development of Powder River data adequacy standards. These discussions resulted in the Powder River RCT's endorsement of a Federal/State task force effort to develop data adequacy standards necessary to make tract leasing decisions. To this end, the Federal/State task force conducted a series of meetings among the task force members and with other Federal/State specialists on particular subjects. This interdisciplinary approach resulted in a final product in November of 1987.

In 2011 the process of revising these standards began as it had become apparent that new issues had developed and needed data collected in order to address them. Furthermore, revised

collection methodology had been implemented since 1987 that needed to be set into the standards. A taskforce comprised of technical specialists was assembled and tasked each with updating their specific sections on the requirements for data collection and presentation for coal leasing environmental analysis documents.

One issue that the original and the 2011 task force identified was that much of the data required for a given resource was also germane to other resources. For example, data necessary to assess reclamation potential is in part a composite of soils, hydrology and wildlife information. Also, overburden geology overlapped with soils data. Given these and numerous other interrelationships, the task force was asked to consolidate overlap areas where possible into logical chapters. This consolidation is intended to avoid redundancy. It is not intended that the resource specialists for other resources will only rely on the data set out under their particular chapters when evaluating the impacts of coal development. All resource specialists will have access to any data necessary, except that which is confidential, to conduct environmental impact analyses.

An important factor to keep in mind when reviewing these standards is that they are limited to environmental data level quantifications that are necessary for making coal leasing environmental evaluations which are necessary in order to then make recommendations and decisions on coal leasing.

These standards are not applicable Bureau's Land Use Planning. Land use planning is an earlier tier, prior to activity planning, in the overall leasing process. The standards proposed in this paper identify the minimum data necessary to offer specific tracts for lease.

The Powder River RCT adopted the 1987 standards for the Powder River Coal Region. The RCT will not adopt standards for or guide the Bureau's land use plans, because such actions are beyond the RCT charter.

These standards should also not be confused with the data necessary for a State mining permit. In many cases additional data will be necessary prior to mining authorizations, which can occur up to 10 years after the lease is issued. During this interval environmental conditions may change. Detailed site-specific mining and reclamation techniques are also outlined. Therefore, more current and intensive site-specific data are essential at this later tier in the coal management process.

OTA indicated there should not be "cookbook" standards for all regions, but guidelines with sufficient flexibility to accommodate regional differences in data needs. Professional discretion on the part of the resource specialists and coal leasing decision-makers must be a key ingredient to any data adequacy determination. In summary, these standards serve as a starting point for determining whether sufficient data exists to lease coal. Any significant variation from these standards may be permissible but warrants justification.

The remainder of this document outlines BLM’s proposed, updated data adequacy standards by resource for leasing coal in the Powder River Coal Region.

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GEOLOGY

Minimum data standards for coal resource analysis are designed to provide sufficient geologic data necessary to make coal leasing decisions for the Powder River Basin Coal Production Region. Geologic data are necessary to fully evaluate and characterize coal resources, including mineability and economic value.

Developing minimal geologic data standards for coal resource evaluation is essential in order to make the following assessments:

• Definition and characterization of a coal resource, or deposit, to facilitate tract delineation and development of coal quantity and quality estimates;

• Determine the factors that affect the mineability of a tract in order to develop an optimal mine plan; and

• Preparation of an economic assessment (valuation) of the tract for determination of fair market value in support of a lease modification or sale.

These data include driller's logs, geophysical logs, and coal core quality analyses. Aerial photography, field, or magnetometer surveys may also be needed to determine the location of the coal crop. Coal crop is the limit of the coal. The crop may be where the coal is exposed at the surface or burned beneath the surface or limits of coal due to non-deposition or erosion in the geologic past. Aerial photography may depict surface expression of burn. Magnetometer surveys measure changes in the magnetic field that may occur when rock is heated. The survey is highly responsive to burned rock and may provide detail over an area not practicably obtained by drilling.

Proximate analyses coal core samples are needed at quarter section spacing (one per 160 acres). Short Proximate analyses which evaluate moisture, ash, British Thermal Units (BTU), and sulfur are usually sufficient for evaluating subbituminous coal which is the typical of coal in the Powder River Basin.

Ultimate analyses may be required for certain projects. Ultimate analysis determines chemical composition of coal and may be needed when regulations, laws, or peculiarities of a project require particular evaluation.

Procedures and methodology for the sampling and laboratory analysis of coal samples should adhere to standards established by the American Society of Testing and Materials (ASTM).

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Geophysically logged holes should be evenly distributed at a rate of at least one per 160 acres. Closer spacing will be necessary in areas of faulting, burned coal, or channels which have affected the coal.

Prior to data collection made specifically for these Data Adequacy Standards, a BLM geologist associated with the Solid Minerals Group covering the data collection area should be consulted to determine if there are any specific data collection needs for the area.

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SOILS/RECLAMATION

These minimum soil, topographic, and resource data requirements are intended to provide BLM with sufficient knowledge to make coal leasing decisions in its activity plans for specific tracts.

The use of the soil, vegetation, and topographic data as found in National Cooperative soil surveys and topographic slope maps from United States Geological Survey (USGS) are used to rate a tract based primarily on the properties of soil materials. If the pre-mine soils have adverse properties which result in low productivity, the post-mine soils constructed from these materials may also have low productivity. However, if the volume of soil reconstruction is equal to or greater than the pre-mine soil volume, reclamation potential is "good" at that tract, but may not rank as "good" as another tract.

It is well known that some geologic strata in the overburden has chemical and physical properties suitable for use as soil reconstruction material. Additional data for evaluating overburden as soil material may be available in the geology section. Overburden/spoil can and should be evaluated for use in creating a favorable root zone depth to 8 feet or more.

This effort at data interpretation is meant to evaluate and rank, relative to each other, potential coal lease tracts. It is not intended to replace the specific data requirements of a mine plan.

Objective: To determine from soil surveys the quantity and quality of soil material available; within a designated area, for soil reconstruction.

Tasks

- Determine if a soil survey exists for the area and evaluate according to Tables 1 and 2. An order II survey will provide the information necessary for this assessment.

- Delineate coal tract boundaries on soil survey sheets, topographic maps, or slope maps if these limited slope maps are available.

- Determine areal extent of:
    - soil mapping units (for Table 3)
    - forested areas
    - hay/tame pasture
    - intensive dryland agriculture
    - irrigated areas
    - alluvial valleys
    - areas of unique or special concern (riparian, wetland, rimrocks, scoria, etc.)

- Interpretation of soil mapping units to determine:
    - soils present in tract
    - soil series composition within mapping units (Table 3)
    - prime farmland soils
    - soils of statewide importance

- saline soils
- sodic soils
- land capability class
- potential natural vegetation community, grasses, forbs, shrubs, and trees, from ecological site descriptions (ESD).

- Rating of soils for:
  - soil reconstruction material; Table 603-25 of National Soil Survey Handbook (NSSH)
  - determine volume (acre-feet) of soil in tract in good, fair, and poor categories; Tables 603-25, 4 and 5
  - seeding mixtures; can be generalized from the ecological site descriptions.

Scope and Intensity

This narrative explains a method for acquiring minimum soil resource data and making interpretations, as available from soil surveys published by the Natural Resources Conservation Service (NRCS) and others. The soils in a potential tract are identified, delineated, and the included accompanying reports list the capabilities and limitations of soils for various uses and management. This information must be interpreted by experienced field soil scientists for other disciplines. These data are a combination of background and specific data needed to evaluate and rank potential coal lease tracts. This method is meant for evaluating potential tracts to be ranked relative to each other and should be viewed in that light. It is not intended to replace the site specific data requirements of a mine plan.

Soil surveys done at third order detail, (Tables 1 and 2, on 1:20,000 or 1:24,000 scale maps) will provide sufficient data to evaluate and compare natural resources such as soils, vegetation and topography in potential coal lease tracts. The soil survey may provide data such as soil chemical and physical properties, ecological vegetation types, potential prime farmlands and potential alluvial valley floors (AVFs, Table 6). The data adequacy value of soil survey orders by a particular use is in Table 2 and refers to current soil mapping techniques at 1:24,000 scale.

The delineation of a potential coal tract on soil survey base map will enable a soil scientist to determine extent of soil mapping units, vegetation types, or selected land uses to complete Tables 3 through 6. These tables will provide methods to interpret information to compare potential coal lease tracts.

The required depth of soil material rated good and fair needed for soil reconstruction is arbitrarily set at two times the average annual precipitation (AAP) the proposed tract receives (e.g., 2 x 15" AAP = 30", Table 7). A narrative ranking is obtained, to facilitate the comparison of potential tracts, by combining the soil material by rating, from Table 5, and by the total acres in the tract, converted to inches and is then divided by two times the average annual precipitation the tract receives. The resulting percentage is compared to Table 7, to obtain a narrative reclamation potential for tract ranking. The information contained in Tables 2 through 6 provides an insight into a potential coal tract's character, enabling comparison and ranking.

Example - If a 262-acre tract in a 14" average annual precipitation zone was: soil mapped at order three, composed of 2 soil mapping units, which identified soil composition, slope, and ecological site (Table 3), and rated in Table 4 for soil reconstruction material, the values for Table 5 would be determined in this manner:

- Soil Map Units: 13C may have 79 surface acres, composed of 1 soil (100% Busby) 129F may have 183 surface acres, composed of 2 soils (65% Birney and 35% Cabbart)

- Busby (13C)
  79 ac. x 100% x 3.92' (47") x good rating = 310 ac. ft.
  79 ac. x 100% x 1.08' (13") x poor rating = 86 ac. ft.
  396 ac. ft.
- Birney (129F)
  183 ac. x .65% x .916' (11") x fair rating = 109 ac. ft.
  183 ac. x .65% x 4.084' (49") x poor rating = 486 ac. ft.
  595 ac. ft.
- Cabbart (129F)
  183 ac. x .35% x 1.5' (18") x fair rating = 96 ac. ft.
  183 ac. x .35% x 3.5' (43") x poor rating = 224ac. ft.
  320 ac. ft.

The total tract has 310 acre feet of good, 205 acre feet of fair, and 796 acre feet poor rated material giving it a "fair" reclamation potential for tract ranking purposes (Table 7).

Suitable Overburden

Suitable overburden may raise this rating to "good" for tract ranking purposes. Acres x strata depth (e.g., 46' to 59' - 13 ft.) x rating from Table 603-25 = ac. ft.

Table 1. Key for Identifying Kinds of Soil Surveys

Level of data needed	Field procedures	Minimum-size delineation (hectares)[1]	Typical components of map units[2]	Kind of map units	Appropriate scales for field mapping and publications
1st order - Very intensive (i.e., experimental plots or individual building sites.)	The soils in each delineation are identified by transecting or traversing. Soil boundaries are observed throughout their length. Remotely sensed data are used as an aid in boundary delineation.	1 or less	Phases of soil series, miscellaneous areas.	Mostly consociations, some complexes, miscellaneous areas.	1:15,840 or larger
2nd order - Intensive (e.g., general agriculture, urban planning.)	The soils in each delineation are identifies by field observations and by remotely sensed data.	0.6 to 4	Phases of soil series, miscellaneous areas, few named	Consociations, complexes; few associations and undifferentiated	1:12,000 to 1:31,680

Level of data needed	Field procedures	Minimum-size delineation (hectares)[1]	Typical components of map units[2]	Kind of map units	Appropriate scales for field mapping and publications
	Boundaries are verified at closely spaced intervals.		at a level above the series.	groups.	
3rd order - Extensive (i.e., range or community planning.)	Soil boundaries plotted by observation and interpretation of remotely sensed data. Soil boundaries are verified by traversing representative areas and by some transects.	1.6 to 16	Phases of soil series or taxa above the series; or miscellaneous areas.	Mostly associations or complexes, some consociations and undifferentiated groups.	1:20,000 to 1:63,360
4th order - Extensive (e.g., general soil information for broad statements concerning land-use potential and general land management.)	Soil boundaries plotted by interpretation of remotely sensed data. Boundaries are verified by traversing representative areas and by some transects.	16 to 252	Phases of soil series or taxa above the series or miscellaneous areas.	Mostly associations; some complexes, consociations and undifferentiated groups.	1:63,360 to 1:250,000
5th order - Very extensive (e.g., regional planning, selections of areas for more intensive study.)	The soil patterns and composition of map units are determined by mapping representative ideas and like areas by interpretation of remotely sensed data. Soils verified by occasional onsite investigation or by traversing.	252 to 4,000	Phases of levels above the series, miscellaneous areas.	Associations; some consociations and undifferentiated groups.	1:250,000 to 1:1,000,000 or smaller

[1.] This is about the smallest delineation allowable for readable soil maps (see Table 2-2). In practice, the minimum-size delineations are generally larger than the minimum-size shown.
[2.] Where applicable, all kinds of map units (consociations, complex, associations, undifferentiated) can be used in any order of soil survey.

Table 2. Data Adequacy Value

Soil Survey Order	Land Use Planning	Activity Planning (Tract Ranking)	Mine Plan (Permit Standards)
Order 1	4	4	3
Order 2	4	3	2
Order 3	4	3	1
Order 4	3	1	N/A
Order 5	1	N/A	N/A

4 = exceeds requirements
3 = Data are adequate
2 = Adequacy of data is doubtful

1 = Data are inadequate

Table 3. Soil Mapping Units

Mapping Symbol	Name	Slope	*LCC	Approximate Surface Acres
13c	Busby fine sandy Loam	2 to 8%	IVe	79
129 F	Birney-Cabbart complex, forested	25 to 75%	VIIe	183

This table is to be used to list all soil mapping units mapped in the proposed lease area.

*LCC - Land Capability Classification; ranges from I to VIII, with VIII being "badlands" type topography and soils. Montana and Wyoming do not have Class I agricultural lands.

Table 4. Rating for Soil Reconstruction Material by Soil Series[1]

Series	Depth	Rating	Restrictive Feature
Birney	0-11”	Fair	large stones
	11-60”	poor	large stones
Busby	0-47”	good	
	47-60	poor	too sandy
Gabbart	0-18”	fair	excess lime
	18-60”	poor	weathered bedrock

[1]These soils are used as examples only and ratings are determined from Table 603-25, from Section 603.03-3(e)(3) of National Soils Handbook.

This table is used to list all soil series identified in the proposed lease area. This would ignore slope and equipment constraints required to collect and save this resource. This table would be done for the entire tract, preferably by section or partial section.

The series horizon depths would come from the descriptions of the typifying soil pedons mapped in the tract/survey.

Table 5. Soil Available for Reconstruction Material

Soil Mapping Unit	Surface Acres and %	Soil Good (ac. ft.)	Reconstruction Fair (ac. ft.)	Material ** Poor (ac. ft.)
e.g. 13c (Busby)	e.g. 79 Ac., 2.7%	e.g. 310*	---*	e.g. 86*
e.g. 129F (Birney, Cabbart)	e.g. 183 Ac., 6.3%	0	205	710

This table would have ALL of the identified soils in the tract rated; the values by use, would be entered, and tract totals could be determined.

* Total volumes here to be used in Table 7

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** Ratings are determined from Table 603-25 from Section 603.03-3(e)(3) National Soils Handbook.

Table 6. Tract Resource Data by Slope[1]

Land Use Characteristics	Acres	≤ 15% Slope % Composition	> 15 Acres	≤ 25% Slope % Composition	Acres	> 25% Slope % Composition
Grazing Land						
Forested Lands						
Hay/tame Pasture					N/A	N/A
Intensive Agriculture Dryland					N/A	N/A
Irrigated						
Flood					N/A	N/A
Sprinkler						
Border Dike						
Other						
Prime Farmland Soil[2]					N/A	N/A
Soil of Statewide Importance						
Alluvial Valley Floors			N/A	N/A	N/A	N/A
Saline Soils[2]						
Sodic[2]						
Totals						

[1] This table can be done by tract, section or specific landscapes
[2] Preliminary acres, pending further study

Table 7. Tract Reclamation Potential

Reclamation Potential	Reclamation Material Available
Good	≥100% of two times average annual precipitation (2 x AAP) of soil material rating good and fair, with 1/5 or more of that volume being soil material rated good for topsoil.
Fair	<100% but > "66% of 2 x AAP of soil material rating good and fair; and/or having less than 1/5 of that volume being soil material rated good for topsoil.
Poor	< 66% of 2 x AAP of soil material rating fair and/or no soil material rating good for topsoil.

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Example: A 262-acre tract having 14" as average annual precipitation, which had 5l5 acre feet of material rating good and fair reclamation potential and ≥ 1/5 of that volume (103) was material rating good for topsoil would have a fair rating for reclamation.

515 ac. ft./262 acres = 1.96 (23.6 inches) / 2 x AAP (28") = 84%

515 ac. ft. /5 = 103 ac. ft. of topsoil material

If this same tract had more than 100% of the good and fair material and more than 1/5 (103) of that volume was "good" material for topsoil the tract would have a good rating for reclamation. Example: 675 ac. ft. / 262 acres = 2.6' (31") / 2 x AAP (28") = 110% or 103 acre feet of topsoil material.

APPENDIX 1
From: Part 603 - Application of Soil Information
National Soils Handbook
USDA/SCS/Soil Survey Staff

Soil Reconstruction Material For Drastically Disturbed Areas

See Table 603-25. Soil reconstruction of areas drastically disturbed, as in surface mining, is the process of replacing layers of soil material or unconsolidated geologic material or both in a vertical sequence of such quality and thickness that they provide a favorable medium for plant growth.

Most new state strip mine, programs emphasize that the land surface be restored to about its natural configuration or better and the soil be reconstructed to maintain or improve its suitability for the intended use. Thus, knowledge of the soil and underlying material is needed to plan proper reconstruction operations of mined land. This guide for soil reconstruction material evaluates the material as a medium for plant growth. It can be used to rate any segment of the soil profile or unconsolidated geologic material that is thick enough to warrant consideration in planned soil reconstruction. For named kinds of soil, for example, it will be necessary for most purposes to rate the A horizon, the B horizon, and the C horizon separately. If they all rate "good," there may be little justification for keeping them separate for soil reconstruction. If the A horizon is rated better than the B or C, then it generally should be kept separate, depending upon its thickness and the anticipated use of the land. This guide does not cover quarry, pit, dredge, and older surface mine operations that require an offsite source of soil reconstruction material--the guide "Daily Cover for Sanitary Landfill is useful to evaluate the material used in restoration of these operations.

When the soil materials are properly used in reconstruction, a rating of good means vegetation is relatively easy to establish and maintain, the surface is stable and resists erosion, and the reconstructed soil has good potential productivity. Material rated fair can be vegetated and stabilized by modifying one or more properties. Topdressing with better material or application of soil amendments may be necessary for satisfactory performance. Material rated poor has such severe problems that re-vegetation and stabilization are very difficult and costly. Topdressing with better material is necessary to establish and maintain vegetation.

The major properties that influence erosion and stability of the surface and the productive potential of the reconstructed soil are listed in the guide.

Excessive amounts of substances that restrict plant growth, such as sodium, salt, sulfur, copper, and nickel, create problems in establishing vegetation and, therefore, also influence erosion and the stability of the surface. Other substances, such as selenium, boron, and arsenic, get into the food chain and are toxic to animals that eat the vegetation. Of all these substances, only sodium and salt are criteria in the guide. If relatively high levels of toxic substances are in the reconstruction material, the material should be rated poor. Laboratory tests may be needed to properly identify toxic substances.

Materials that are extremely acid or have the potential upon oxidation of becoming extremely acid are difficult and expensive to vegetate. They also contribute to poor water quality, both in runoff or in ground water. Materials high in pyrite and marcasite without offsetting bases have high potential acidity. Laboratory tests may be needed to properly identify these materials.

Vegetation is difficult to establish on soils that have high pH. Many of these soils also have a high sodium absorption ratio which indicates potential instability and water transmission problems.

The available water capacity also is important in establishing vegetation. Soils that have a low available water capacity may require irrigation for establishment of vegetation.

The stability of the soil depends upon its erodibility by water and wind and its strength. Water erodibility is indicated by the K factor; wind erodibility is rated according to the wind erodibility group. Potential slippage hazard is related to soil texture, and although other factors also contribute, the ratings of soil texture represent one important factor.

USDA texture also influences a number of properties listed above such as available water capacity and erodibility by wind or water. Texture also influences soil structure and consistence, water intake rate, runoff, fertility, workability, and trafficability.

Fraction greater than 3 inches is a weight percentage of rock fragments in the material used for soil reconstruction. Rock fragments influence the ease of excavation, stockpiling, and re-spreading and suitability for the final use of the land. A certain amount of rock fragments can be tolerated depending upon size and the intended use of the reclaimed area. If the size of rock fragments exceeds 10 inches, the problems are more severe.

This guide does not cover all the soil features considered in planning soil reconstruction, for example, slope, thickness of material, ease of excavation, potential slippage hazard, and soil moisture regime. Slope of the original soil may influence the method of stripping and stockpiling of reconstruction material but may have little effect on the final contour and, therefore, on the stability and productivity of the reconstructed soil. Therefore, slope is not a criterion in this guide.

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Thickness of material suitable for reconstruction and ease of excavation are important criteria in planning soil reconstruction operations. However, they are so dependent on the method of mining operations that they cannot be used as criteria in this guide. Potential slippage hazard is related to soil texture, slope, differential permeability between layers, rainfall, and other factors which are not included in the guide. Soil moisture regime, climate, and weather influence the kind of vegetation to plant and the rate of re-vegetative growth. They are not used as criteria because the relative ranking does not change with variable moisture regimes; that is, the best soil in a moist environment is the best soil in a dry environment. Furthermore, the soil may be irrigated to establish vegetation.

Table 603-25. Soil reconstruction material for drastically disturbed areas

Property	Limits			Restrictive Feature
	Good	Fair	Poor	
Sodium Adsorption	<5	5-12	>12	Excess Sodium
Salinity (MMHOS/CM)	<8	8-16	>16	Excess Salt
Toxic Materials	Low	Medium	High	Toxicity
XVII[1]/Soil Reaction (pH) (0-40")	5.6 – 7.8	4.5 – 5.5	32[2]/ 4.5	Too Acid
Available water capacity (in/in)	>.10	05-0.10	<.05	Droughty
Erosion Factor (K)	.35	.35	--	Erodes Easily
Wind Erod. Group	---	---	1,2	Soil blowing
USDA Texture	---	SCL, CL, SICL	*5/C, *5/SIC, *5/SC	Too Clayey
USDA Texture	--	LCOS,LS,LFS, LVFS	COS,S,FS,VFS	Too Sandy
Coarse Frag. (WT PCT) 3-10 IN. >10 IN.	 <15 <3	 15-32 3-10	 >35 <10	 Large Stones Large Stones

XVII[1] / Layers with high potential acidity should be rated "POOR-TOO ACID".
32[2] / Rate "FAIR-TO ACID" if found deeper than 40 inches.
*5/ If in kaolinitic family, rate one class better if experience confirms.

Criteria used to determine soil sensitivity and/or suitability to surface uses would continually be adapted as conditions change or new information or technology becomes available that enhances the understanding of the soil resource.

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HYDROLOGY

The data and data standards detailed below are expected to provide the Bureau of Land Management (BLM) with sufficient hydrologic information to make coal leasing decisions. A primary federal law that applies to coal mining is the Surface Mining Control and Reclamation Act of 1977 (SMCRA). For a more in-depth treatment of hydrologic data requirements and standards for coal leasing, see D. B. Richards (1985), Volume I and D.B. Richards (1987), Volume II. The following general categories are presented here:

1. Stream and groundwater flow data for the region.
2. Water resource inventories on lands considered for leasing and adjacent land.
3. Information necessary to apply unsuitability criteria.
4. Data to evaluate probable levels of hydrologic disruption.

The above categories are obviously interrelated. It must also be recognized that site-specific studies needed to assess the hydrologic consequences of mining are dependent upon continued support of regional data collection and modeling studies. For example, methods to predict ground water quality changes in the spoil piles in potential lease areas are provided by mine spoil studies at existing mines. These and similar studies are needed to verify and refine techniques in addition to developing methods to predict ground water quality changes off site. Also indirect methods, such as hydrological modeling, can provide important estimates of current conditions and potential future changes that may result from a proposed action.

Examples of information needed for a coal mine permit include (D.B. Richards, 1985):

- Location, topography, and climate.
- Geologic setting.
- Hydrologic setting, data inventory, aquifer test results, base flow determination, water quality data, water use, groundwater monitoring plan.
- Potential impacts of mining, predicted water level declines, potential water level declines, change in groundwater storage, overburden analysis, potential water quality degradation.
- Post mining hydrologic conditions.

I. Essential Water Flow Data

Tasks

1. Identify all basins and watercourses that potentially have direct impacts from the proposed project: use the latest U.S. Geological Survey (USGS) National Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD)(USGS, Online). Identify watercourses flanked by probable Alluvial Valley Floors (AVFs). The smallest set of basin(s)/subbasin(s) identified will constitute the initial "region" of examination for the proposed project. Investigation of the down gradient impacts will initially be limited to the first basin/subbasin downstream having a defined Hydrologic Unit Code (HUC).

2. Identify all aquifers within the region that have the potential to be impacted by mining operations and associated water production wells or water sources.

3. Evaluate:
    - Basin runoff characteristics (3-years minimum record or use indirect methods such as numeric modeling)
    - Basin stream flow and water quality (3-years minimum record)
    - Basin surfacewater/groundwater interactions.

Scope and Intensity

Tasks listed above are not tract-specific. They apply to basins, or subbasins, in the region as defined by the USGS WBD in Task 1. above. Identifying watercourses flanked by probable AVFs are one object of these investigations, and those watercourses will be defined by the USGS NHD (USGS, Online). Any discrepancies between these USGS datasets and conditions identified in the field should be reported. A minimum of three years of stream flow records (standard USGS techniques) should be available to assess mean annual runoff, peak and low flow conditions, and water quality conditions. Continuous record stations need not be located if adequate data can be projected statistically or aerially to them. Placement of those stations that are needed should be determined by judgments or adequacy of records, for modeling purposes, to assess cumulative impacts and/or AVF questions. Basic runoff and groundwater flow models will be developed to identify groundwater flow direction (per aquifer) and basin wide runoff from 2-year, 10-year, and 100-year storm events. A broader scale review of effects should also be incorporated into the numeric modeling effort. An example of a cumulative analysis is AECOM (2014), which could be included or referenced for Powder River Basin coal projects, as long as the data remains suitable.

All perennial, intermittent, and ephemeral stream reaches should be investigated at least once during low-flow conditions to determine surfacewater / groundwater interactions in terms of quantity and quality. Additional attention should be directed to probable AVFs. Where possible these investigations should be accomplished through synoptic stream flow measurements and

sampling. Reaches of gain and loss can be determined for larger streams through direct data collection, comparisons of records from continuous-record stations, and/or numeric modeling.

II. Water Resource Inventory

Tasks

4. Identify water reservoirs and describe:
    - Runoff fed
    - Spring fed
        - geologic sources and associated aquifers
        - water quality and quantity
    - Groundwater (i.e., CBNG discharge, water well, etc.) fed
        - geologic source and associated aquifers
        - water quality and quantity
    - Water uses and the quantity of water consumption

5. Identify springs and streams (perennial, intermittent, and ephemeral) and describe:
    - Water quality/quantity
    - Water uses and the quantity of water consumption
    - Geologic sources and associated aquifers

6. Identify sub-irrigation and describe:
    - Acreage
    - Crops

7. Identify surface irrigation and describe:
    - History (since 1977)
    - Acreage
    - Crops

8. Identify wells and describe:
    - Water uses, rate of water production, and the quantity of water consumption
    - Well depths and static water levels, well construction; (i.e., casing material, location of perforations, gravel pack, plugs, seals, etc.)
    - Geologic sources of water and associated aquifers
    - Water quality

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- All wells drilled and designed for other than water production (i.e., monitoring wells, coal bed methane wells, etc.)

9. Inventory surface and ground waters in order to:
    - Identify future water draw down potential
    - Quantify water consumption impacts

10. Identify and catalog all water dependent resources within the basins identified in Task 1. (i.e., riparian areas, populations of native fish, etc.).

11. Identify and catalog all water rights or permits within the basins identified in Task 1.

Scope and Intensity

These tasks require at least1:24,000 topographic maps, pursuant to SMCRA provisions, aerial photographs at best available scale, and field work. The objective here is to learn as much as possible about water uses and hydrologic conditions from inventory, field reconnaissance, and modeling. One product of this work is to develop a water budget or hydrologic balance. This could minimize the need for test drilling during the initial stages of study. Water uses may be identified from water rights filings available from state agencies, maps, and from photos; surface-owner or lessee discussions can provide more information. Some well data may be obtained from groundwater files at appropriate Federal and State agencies, and from field reconnaissance; geologic sources of water may be estimated from geologic data collected during coal resource appraisals. Most of the information obtained in the inventory process will have additional application in applying the unsuitability criteria and/or in judging probable levels of hydrologic disruption, so attempts to obtain all available data are worthwhile here. Those efforts may include the drilling, construction, and testing of more than one test or observation well. Test wells could be converted to production or monitoring purposes should a lease be granted, or they would be required to be formally abandoned if not.

Intensity of data collection will depend upon the current level of water use in a delineated tract and upon the availability of data. Groundwater appropriation data may be limited. A best effort should be made to fully quantify and provide an estimate of water consumption for any given basin/subbasin. In order to quantify water consumption impacts, a full water budget or hydrological balance shall be developed in a water supply assessment using best available data and science.

A project's proposed groundwater extraction shall not contribute to exceeding the estimated perennial yield for the region in which the extraction is taking place, as defined in Task 1. Perennial yield is that quantity of groundwater that can be withdrawn from a groundwater basin

without exceeding the long-term recharge of the basin or unreasonably affecting the basin's physical and chemical integrity. It is further clarified arithmetically below.

A principal purpose of the water supply assessment is to determine whether over-use or over-draft conditions could exist within the project basin(s), and whether the project creates or exacerbates these conditions. The assessment shall include an evaluation of existing extractions, water rights, and management plans for the water supply in the basin(s) (i.e., cumulative impacts), and whether these cumulative impacts (including the proposed project) can maintain existing land uses as well as existing aquatic, riparian, and other water dependent resources within the basin(s). This assessment should identify:

- ⇨ All relevant groundwater basins or sub-basins and their relationships.
- ⇨ All aquifers in the basin(s) that are potentially impacted, including their dimensions or extent, whether confined or unconfined, estimated hydraulic conductivity and transmissivity, groundwater surface elevations, and direction and movement of groundwater.
- ⇨ All surface water basin(s) related to water runoff, delivery, and supply, if different from the groundwater basin(s).
- ⇨ All sites of surface outflow (streams, springs, or seeps) contained within the basin(s), including historic sites.
- ⇨ All other surface water bodies in the basins(s), including rivers, streams, ephemeral washes/drainages, lakes, wetlands, and floodplains.
- ⇨ The water requirements of the proposed project and the source(s) of that water.
- ⇨ An analysis demonstrating that water of sufficient quantity and quality is available from identified source(s) for the life of the project.
- ⇨ An analysis of potential project-related impacts on water quality and quantity needed for beneficial uses, reserved water rights, or habitat management within or down gradient of the groundwater basin within which the project would be constructed.

A product of the water supply assessment shall be a baseline water budget (or hydrologic balance), which shall be established based on the best -available data and hydrologic methods for the identified basin(s). This water budget shall classify and describe all water inflow and outflow to the identified basin(s), or system, using best-available science and the following basic hydrologic formula or a derivation:

$$P - R - E - T - G = \Delta S$$

where P is precipitation and all other water inflow or return flow,

R is surface runoff or outflow,

E is evaporation,

T is transpiration,

G is groundwater outflow (including consumptive component of existing pumping), and

ΔS is the change in storage.

Typical volumes in this calculation are in units of either acre-feet per year or gallons per year. The water budget shall quantify the existing perennial yield of the basin(s).

Perennial yield is defined arithmetically as that amount such that:

$$P - R - E - T - G \geq 0$$

Water use by groundwater dependent resources is implicitly included in the definition of perennial yield. For example, in many basins the transpiration component (T) includes water use by groundwater dependent vegetation. Similarly, groundwater outflow (G) includes discharge to streams, springs, seeps, and wetlands. If one or more budget components is altered, then one or more of the remaining components must change for the hydrologic balance to be maintained. For example, an increase in the consumptive component of groundwater pumping can lower the water table and reduce transpiration by groundwater-dependent vegetation. The groundwater that had been utilized by the groundwater dependent vegetation would then be considered "captured" by groundwater pumping. Similarly, increased groundwater consumption can capture groundwater that discharges to streams, springs, seeps, and wetlands. These changes can occur slowly over time, and may require years or decades before the budget components are fully adjusted. Accordingly, the water supply assessment requires that the best-available data and hydrologic methods be employed to quantify these budgets, and that groundwater consumption effects on groundwater-dependent ecosystems be identified and addressed.

III. Unsuitability Criteria: Alluvial Valley Floors and Flood Plains[1]

Tasks

12. Identify and map:

- Active flood plains (perennial, intermittent, and ephemeral), associated channels, and terraces within the basin(s) identified in Task 1.
- All areas and evidence of historic surface irrigation
  - non-irrigated land physiographically similar to the irrigated land
  - areas of suspected sub-irrigation
- 2-year, 10-year, and 100-year floodplains

[1] Municipal watersheds and National Resources waters are also identified as unsuitability criteria.

Scope and Intensity

The objective is to avoid or minimize coal leasing of tracts which might negatively impact water quality, water quantity, and significant farming, pursuant to SMCRA provisions. Leasing might proceed where AVF or floodplain determinations are not a factor, or with stipulations that apply rigorous reclamation criteria. A third option is the re-delineation of proposed lease tract boundaries to avoid the identified and potential impacts.

The processes of mapping irrigated and potentially irrigable land (under the AVF definitions) have been described in detail by the Office of Surface Mining Reclamation and Enforcement Handbook (1983). "Alluvial valley floors" (AVF) are defined in SMCRA as:

"*the unconsolidated stream laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits by unconcentrated runoff or slope wash, together with talus, other mass movement accumulation and windblown deposits."*

An active flood plain (see Task 11. above), is in contrast to a geologic "terrace", and can reasonably be limited to the area impacted by a 100-year flow event or the 100-year flood plain. Regional maps, such as those available through the USGS NHD and WBD, should be examined. Maps of surficial geology should also be consulted. Tract-specific mapping may be necessary. Aerial photos and topographic maps (1:24,000) can be used to draw boundaries of channels and associated irrigable lands. These maps should augment information developed from hydrologic modeling required by the tasks above. This work would presumably be conducted in conjunction with soils and vegetative investigations having the same objectives. Considerable information, available through the NRCS-USDA, can be used as a base for site specific work.

If suspected AVFs are found within a delineated basin, some basic considerations of the hydrologic budget become necessary. These considerations can be applied using the modeling discussed above along with the detailed descriptive information detailed below.

IV. Probable Levels of Hydrologic Disruption

Tasks

13. Identify aquifers, and their surface expressions, that would be physically disrupted and/or be directly impacted by mining, and describe:

    - Depth-range(s) below surface
    - Confining layers, or aquitards
    - Generalized geologic structure
    - Generalized potentiometric surface(s)
    - Generalized areas of groundwater recharge/discharge

- Estimated rates of groundwater flow
- Aquifer characteristics (hydraulic conductivity, transmissivity, storage coefficient, etc.)
- Water quality
- Interrelationships (discharge and recharge) with special hydrologic features
    - possible aquitards identified within the basin or subbasin
    - watercourses within the identified basin or subbasin
    - Springs within the identified basin or subbasin
    - possible AVFs within the identified basin or subbasin

14. Identify any potentially mineable coal, or coal seams, below the shallowest aquifer.

15. Identify aquifers below the mineable coal (alternate supplies) and describe:

    - Depth-range(s) below surface
    - Aquitards between the aquifer and the mineable coal
    - Estimated potentiometric surfaces
    - Water quality

16. Identify probable hydrologic consequences of a theoretical mine by estimating:

    - Influent rates and water quality into the mine
    - Effluent rates and water quality out of the mine
    - Probable disposal of effluents
        - watercourses
        - infiltration
        - other
    - Post-mining water quality
        - chemical species present, points of concentration, and estimates of the magnitude of the impact
        - direction and rate of flow
        - potential effects on off-site conditions
    - Site-specific and cumulative effects on quantity and quality of existing water sources.

<u>Scope and Intensity</u>

Objectives are to obtain additional tract specific data and to make estimations of probable cumulative hydrologic consequences of mining. These can then be applied to a tract-ranking process and to the water balance aspects of the unsuitability criteria. Much of the data obtained during the stream flow, inventory, and unsuitability criteria investigations will be needed along with some or all of the following: (a) detailed geologic information available from the coal-resource appraisals; (b) surface maps of bedrock, clinker, aquitards, and alluvium; (c) observation wells; (d) overburden mineralogical and soluble-salt analyses; (e) aquifer tests; (f) water quality analyses; (g) water level monitoring; and (h) stream flow measurements.

Scope and intensity during these investigations must be determined by the hydrologic significance and complexity of a given tract and adjacent area. One proposed tract classification system makes four class distinctions based on the location of mineable coal relative to the water table. The first, Class I, is where surface mineable coal lies above the water table, there is no suspected AVF within the identified basin or subbasin, and impacts to other resources are expected to be limited. Required minimum activities would include: at least one test or observation well into any underlying aquifer with aquifer testing and water quality monitoring, geotechnical study of the overburden, and basin wide numeric modeling of surface waters that includes predictions of impacts to flow rates and water quality. The second, Class II, is similar, but includes the suspected presence of AVF and/or impacts to other resources. The third, Class III, is similar, except that the mineable coal is found below the water table. The fourth, Class IV, is differentiated from Class I because the coal is found below the water table <u>and</u> there is the suspected presence of AVF and/or impacts to other resources. Class IV would require a minimum of 3 test or observation wells with aquifer testing and water quality monitoring, more extensive geotechnical studies would be expected, and an expanded modeling effort would be needed that included groundwater quality, quantity, and flow directions. The level of effort for data collection will increase incrementally from Class I to Class IV and depend largely on the level of identified impacts to the hydrological system within the proposed tract's basin. Note that data collection efforts would also increase depending upon the source of water proposed for use in mining operations without regard to these classes. A thoroughly documented source, for example, may require less examination and data collection than water production for operations that come from an underlying aquifer not currently being used locally. Production from multiple aquifers might also increase data collection.

The minimum data standards listed above are, in fact, a combination of data and interpretations which would allow tract ranking and preliminary considerations of hydrologic budget for the effects in question. For predictions of hydrologic disruption, a hypothetical mine is superimposed on the tract and estimates of active and post-mining conditions are made. An example that might be used as a template is the BLM, *Buckskin Mine – Hay Creek II Coal LBA Environmental Impact Statement*, BLM – Wyoming High Plains District, Casper Field Office, May 2008, Revised September 2009.

Review of AVF considerations, or other resource impacts, may be necessary as data and information is developed. One important consideration is the hydraulic connection, a determination of whether any aquifers that would be penetrated during mining have hydraulic continuity with AVF or identified resources within the basin(s). This may be already obvious from earlier work. Another consideration is the percentage of potential AVF watershed found within a proposed tract. This should be readily determined from topographic maps. With no subsurface continuity between an aquifer and an AVF, and with a tract that occupies very little, or no part of an AVF's watershed, less work may be necessary. If there is hydraulic connectivity, notable AVF present, or other hydrological impacts are expected, investigations may be necessary and more extensive modeling of the hydrologic budget will probably be needed before an AVF determination can be made.

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WILDLIFE

This paper presents the minimum data requirements needed to make coal leasing/mitigation recommendations for wildlife populations and their habitats within the Powder River Coal Production Region. The data standards described herein would be applicable to those tracts under leasing consideration within any given round of Powder River coal activity planning. These data requirements are intended to act as the minimum standard for evaluating the adequacy of wildlife data bases as well as for determining whether additional inventories are required. The data adequacy standards are also intended to assure that a sufficient amount and quality of resource information is available for use at the time a coal leasing decision is made.

Tasks

It must be emphasized that the standard presented herein is the minimum, or threshold level, information required to make informed and proper coal leasing decisions. It should not necessarily be construed as the "norm" or the maximum level of information needed. For example, in the northern Great Plains the climatic and habitat conditions on the winter range are usually the most limiting factor on big game populations. The minimum data standard presented herein calls for one winter season of inventory for big game. It is quite conceivable that a mild winter could occur during the data gathering period yielding a big game data base that was not representative of the most crucial conditions on the proposed lease tract. In this situation, the manager involved and his advisors (i.e., wildlife, watershed staffs) would have to recognize the circumstances and modify their data base by continuing big game winter season inventories until a representative data base was obtained. In this fashion an adequate data base could be acquired even though it required more work than the minimum standards outlined herein. Examples of possible situations that might require a deviation from the minimum standard include, among others: (1) unusual weather conditions during the data gathering period, (2) the occurrence of a "unique" animal population or habitat in the potential lease area, or (3) previous information gathered is considered of inadequate quality. In addition, any data over 5 years of age should be given extra special scrutiny during the evaluation process to determine if it is still relevant.

For many species and their habitats, the methods for survey change from time to time, and the status of the species themselves are subject to change. At the beginning of the project, the proponent should contact a wildlife biologist in the appropriate BLM/USFS office where the project is located for current species status lists, and protocols for data collection.

The following discussion provides general guidance to assist in evaluating the wildlife data adequacy. Before any coal leasing/mitigation decisions are made relative to wildlife populations and their habitats, the following data requirements must be satisfied (where pertinent):

- Big Game Species
    - Species occurrence
    - Include seasonal use/crucial range maps from Wyoming Game & Fish Department (WGFD)
    - Relative abundance

- Migration routes

Seasonal inventories will be conducted by vehicle and foot observations with a minimum of one aerial observation flight each month from November through April. Surveys should include at least a 2-mile zone from the perimeter of the lease area. Surveys may extend beyond a 2-mile zone if circumstances warrant. Species occurrence, distribution by season and habitat type, relative abundance, migration routes, and important use areas will be measured. As a minimum, each season will be investigated once. Additional seasons may be investigated if the situation warrants a more detailed evaluation.

- Other Mammals

  - Species occurrence
  - Distribution
  - Relative abundance

At a minimum, each habitat type in the lease area will be inventoried once for species occurrence, distribution, and relative abundance during the duration of the study (preferably late July or August) for at least three consecutive trap nights. The BLM/USFS biologist may make exception to this requirement if safety is of concern. Small mammal techniques including pit falls, pincher type traps, snap traps, Sherman live traps, rat traps, and have-a-heart traps can be used. A variety of trap types and baits, coupled with a sufficient level of sampling effort, should be employed to adequately sample species composition. Lagomorph trends should be monitored by roadside counts.

- Raptors

  - Species occurrence by habitat type
  - Distribution
  - Relative abundance
  - Nest sites, status, conditions, and, if available, history
  - Roost/concentration areas

Raptor occurrence, distribution, and relative abundance should be noted from ground and vehicle observation routes. A concentrated aerial and ground search of all rocky cliffs and other potential raptor nesting areas will be made. Raptor nest surveys should follow the C:\Users\kogle\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\UAM2YME5\the most current protocol. See the BLM/USFS biologist for the most current protocol. The Data Report to BLM/USFS will include a table showing raptor nest locations with nest number, UTM NAD83 locations, status, condition and substrate with height of nest as described in the Powder River Basin Interagency Working Group protocol. An electronic spreadsheet of the nesting data needs to be supplied to BLM/USFS. Contact the BLM/USFS biologist for the required format. Locations of raptor feeding areas, and any roosting sites should be determined. Raptor surveys should include the baseline study area and at least a 2-mile buffer zone.

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- Game Birds (Sage-Grouse will be covered as a Candidate Species)

    - Species occurrence by habitat type
    - Distribution
    - Relative abundance
    - Breeding areas (leks, nesting habitat, and roost areas)
    - Important seasonal habitat (i.e., wintering areas)

Presence, distribution, and relative abundance should be determined from spring, summer, and fall observation routes and breeding season surveys. See the BLM biologist for the current accepted protocol. For those species with distinct breeding grounds, breeding ground searches of large sites will require both aerial and ground surveys. Once breeding grounds are found, the number of male birds using the site should be determined. Summer surveys should also be made to determine use of the area by hens with young. Winter surveys should be made to determine the number of birds using the site during that season. Sharp-tailed grouse leks will be surveyed using the same protocol as for sage-grouse. A table with UTM NAD83 location, survey dates, and counts of located sharp-tailed grouse will be included in the Data Report.

- Migratory Birds

    - Species occurrence
    - Distribution
    - Relative abundance
    - Special use areas (nesting, roosting, staging, and concentration)
    - Wetlands by National Wetlands Inventory Classification

Bird surveys for species occurrence, distribution, and relative abundance should be conducted in each vegetation type in the lease area and in each unique or important habitat (i.e., riparian/wetlands, rock outcrops, etc.). Inventory may involve the use of both the vehicle route techniques and walking techniques (point count plots). Two vehicle routes will be run monthly from April through September. If the area contains unique or important habitat types, transects will be established in each of these habitat types. One winter season bird survey should also be conducted (i.e., Christmas bird count, etc.). An evaluation should also be made of the "priority" of existing habitats for Migratory Birds of High Federal Interest (MBHFI), Birds of Conservation Concern (BCC), and BLM/USFS Sensitive Species. A concentrated ground search of all identified "priority" habitats for these species will be conducted within the lease boundary and an appropriate "buffer" perimeter.

After the spring snowmelt, potential habitats will be inventoried in accordance with the National Wetlands Inventory Classification and mapped and a record made of wetland areas such as ephemeral streams, perennial streams, reservoirs, surface water, and ponds. Later in the year (after July 15), a recheck of mapping of each site will be done showing location and permanence of water. Reservoirs and creeks will be checked from April through June for waterfowl occurrence. All waterfowl and broods are to be recorded by date of observation, species,

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location, and size of broods. Surveys for waterfowl species occurrence, distribution, and relative abundance should also be conducted during a fall and winter season.

- Amphibian/Reptiles/Aquatic Species

    - Species occurrence
    - Distribution
    - Relative abundance

Species occurrence, distribution, and relative abundance should be determined by trapping, capture, observation, and calls during the summer. A variety of sampling methods, coupled with a sufficient level of sampling effort, should be employed to adequately ascertain species composition.

- Fish Species

    - Species occurrence
    - Distribution
    - Relative abundance
    - Rearing area
    - Water chemistry
    - Habitat condition
    - Aquatic invertebrates
    - Spawning areas and movements

Seasonal sampling will identify species occurrence, distribution, relative abundance, spawning areas and movements, and rearing areas. Associated aquatic invertebrates, water chemistry, and habitat condition will be sampled. At a minimum, three seasons (spring, summer, and fall) of inventory will be required with a fourth season (winter) of water chemistry to be conducted.

- Threatened, Endangered, Proposed, and Candidate Species/BLM-USFS Sensitive Species

    - Historic use of the area
    - Species occurrence
    - Distribution
    - Relative abundance
    - Critical habitat

Inventories for T&E species and BLM/USFS sensitive species should only use the latest recognized procedures for surveying the species in question. The most current protocols and species lists can be obtained from the wildlife biologist in the BLM or Forest Service office in question.

Sage-Grouse lek and winter concentration area surveys will follow protocols set forth by the Wyoming Department of Game and Fish. Sage-Grouse habitat suitability needs to be assessed

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showing sagebrush cover, density, and height. Recommended procedures are found in, *Sage-Grouse Habitat Assessment Framework Multi-scale Habitat Assessment Tool,* (Stiver et al., 2010).

Bald eagle wintering surveys within one mile of the project will be conducted following accepted BLM protocol. A table that includes number of eagles, UTMs, legal location and date for large amounts of observations will be included in the Data Report. All prairie dog colonies will be listed in a table showing location in UTMs, size in acres and whether active or inactive.

The wildlife biologist from the appropriate office can be contacted for the most updated list of sensitive species: Shape files of sensitive observation locations will be supplied to the appropriate BLM/USFS office. A table of BLM/USFS sensitive species will be included in the Data Report with the following format:

Table XY.Z: BLM/USFS Sensitive Species

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Amphibians				
Northern leopard frog (*Rana pipiens*)	Beaver ponds and cattail marshes from plains to montane zones.			
Columbia spotted frog (*R*anus pretiosa)	Ponds, sloughs, small streams, and cattails in foothills and montane zones of western Wyoming, Montana and the Bighorn Mountains.			
Fish				
Yellowstone cutthroat trout (*Oncoryhynchus clarki bouvieri*)	Cold-water rivers, creeks, beaver ponds, and large lakes in the Upper Tongue sub-watershed			
Birds				
Baird's sparrow (*Ammodramus bairdii*)	Shortgrass prairie and basin-prairie shrubland habitats; plowed and stubble fields; grazed pastures; dry lakebeds; and other sparse, bare, dry ground.			
Bald eagle (*Haliaeetus leucocephalus*)	Mature forest cover often within one mile of large water body with reliable prey source nearby.			
Brewer's sparrow (*Spizella breweri*)	Sagebrush shrubland			
Ferruginous hawk (*Buteo regalis*)	Basin-prairie shrub, grasslands, rock outcrops			
Loggerhead shrike (*Lanius ludovicianus*)	Basin-prairie shrub, mountain-foothill shrub			

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Long-billed curlew (*Numenius americanus*)	Grasslands, plains, foothills, wet meadows			
Mountain Plover	Short-grass prairie with slopes < 5%			
Northern goshawk (*Accipiter gentilis*)	Conifer and deciduous forests			
Peregrine falcon (*Falco peregrinus*)	Cliffs			
Sage sparrow (*Amphispiza billneata*)	Basin-prairie shrub, mountain-foothill shrub			
Sage thrasher (*Oreoscoptes montanus*)	Basin-prairie shrub, mountain-foothill shrub			
Trumpeter swan (*Cygnus buccinator*)	Lakes, ponds, rivers			
Western Burrowing owl (*Athene cunicularia*)	Grasslands, basin-prairie shrub			
White-faced ibis (*Plegadis chihi*)	Marshes, wet meadows			
Yellow-billed cuckoo (*Coccyzus americanus*)	Open woodlands, streamside willow and alder groves			
Mammals				
Black-tailed prairie dog (*Cynomys ludovicianus*)	Prairie habitats with deep, firm soils and slopes less than 10 degrees.			
Fringed myotis (*Myotis thysanodes*)	Conifer forests, woodland chaparral, caves and mines			
Long-eared myotis (*Myotis evotis*)	Conifer and deciduous forest, caves and mines			
Swift fox (*Vulpes velox*)	Grasslands			
Townsend's big-eared bat (*Corynorhinus townsendii*)	Caves and mines.			
Plants				
Limber Pine (*Pinus flexilis*)	Mountains, associated with high elevation conifer species			

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Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Porter's sagebrush (*Artemisia porteri*)	Sparsely vegetated badlands of ashy or tufaceous mudstone and clay slopes 5300-6500 ft.			
William's wafer parsnip (*Cymopterus williamsii*)	Open ridgetops and upper slopes with exposed limestone outcrops or rockslides, 6000-8300 ft.			

Presence	Project Effects
K - Known, documented observation within project area. **S -** Habitat suitable and species suspected, to occur within the project area. **NS -** Habitat suitable but species is not suspected to occur within the project area. **NP -** Habitat not present and species unlikely to occur within the project area.	**NI -** No Impact. **MIIH -** May Impact Individuals or Habitat, but will not likely contribute to a trend towards Federal listing or a loss of viability to the population or species. **WIPV -** Will Impact Individuals or Habitat with a consequence that the action may contribute to a trend towards Federal listing or cause a loss of viability to the population or species. **BI -**Beneficial Impact

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AIR RESOURCES

Current ambient air quality data representative of the potential lease areas and an analysis which estimates potential air quality impacts associated with future mining of these lease areas are necessary to make coal leasing decisions. This analysis of ambient data and projected impacts is to be based upon proposed or reasonably foreseeable mining scenarios. The following data/analyses are necessary to make coal leasing decisions:

1. Existing ambient air quality monitoring data

2. Potential impact analysis
    a. Dispersion modeling assumptions
    b. Dispersion modeling operation

3. Greenhouse gas emissions

Ambient Air Quality Data

<u>Tasks</u>

1. Identify and characterize actual air quality data in the area if available.

2. Evaluate:

    - Data for the pollutant(s) reasonably associated with the anticipated development of the coal tract must be used (i.e., PM_{10}, $PM_{2.5}$, CO, and NOx for coal mines; PM_{10}, $PM_{2.5}$, SO_2, CO, NO_x, and O_3 for a coal mine + power plant, PM_{10},$PM_{2.5}$, SO_2, CO, NO_x, and O_3 for a Synfuels Plant, etc.).
    - Such data are representative if gathered on the potential lease tract. Data from the vicinity of the lease tract can be used as representative if it can be reasonably demonstrated that the data are not influenced by emissions from facilities in a manner significantly different than the air quality at the lease site is affected by such emissions.
    - Data from locations distant from the potential lease site may be used only if representative data for the area are unavailable and if it can be reasonably demonstrated that both locations are subject to similar meteorological conditions, similar land use, and that neither location is influenced by local sources, or that such influence is reasonably similar at both sites.
    - Data used must be for a period of at least twelve consecutive months collected on a schedule frequency of at least once every sixth day, and meet a data recovery rate of at least 80%.
    - Data used must comply with the Quality Assurance Program requirements specified in 40CFR Part 58 Appendix B.

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3. Meteorological Data (See Meteorological Monitoring Guidance for Regulatory Modeling Applications (EPA, 2000) for further details)

- Representativeness. The meteorological dataset must be determined to be representative of the area being modeled prior to use in any dispersion/photochemical modeling. Factors to consider include:

    - Character and complexity of the terrain in the source surroundings and between the source and the meteorological monitoring or observing site;
    - Proximity of the meteorological monitoring site to the source
    - Instrumentation and exposure of the meteorological monitoring site; and
    - Quality, completeness, and period of record of the meteorological data.

- On-site/Off-site.

    - On-site meteorological data is generally defined as data that are collected within close proximity to the modeled source and are truly representative of localized conditions.
    - Off-site meteorological data are defined as data that are generally representative of conditions at the modeled source, although localized variations are not likely to be captured in the data. This is typically from the nearest National Weather Service (NWS) site

- Period of Record

    - On-site. A minimum of one year of on-site is required to conduct air quality modeling
    - Off-site. Three years of off-site meteorological data should be used in any modeling analysis

<u>Scope and Intensity</u>

In reviewing the leasing potential of a given coal tract, the federal land manager must have air quality and meteorological data available to indicate whether or not the tract can reasonably be expected to be developed. Such data must be sufficient to define the state of air quality within the area potentially affected by activities associated with the development of the coal lease. It is not, however, necessary for this definition of air quality condition to be made with respect to pollutants which are not reasonably anticipated to be emitted as a result of the development of the lease. In addition, it is also not necessary that the air quality data be gathered on the area under consideration for leasing.

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Air Quality Impact Analysis

Tasks

Assumptions Regarding Development:

1. Identify type of facility or combination of facilities which will be associated with the lease, i.e., a coal mine, a coal mine plus a power plant, a coal mine plus a synthetics fuel plant, etc.
2. Determine level of development associated with the potential lease. This includes the rate of coal development plus the rate of production of other products such as power or synthetics fuel.
3. Determine the life of the facility as a function of the production defined above and the total quantity of coal to be developed.
4. Determine spatial distribution of the coal production as a function of time. Under some circumstances, it may be possible to assume that the emissions are distributed uniformly over the entire area to be mined in the lease area.

Scope and Intensity

Using the existing air quality data, the federal land manager can determine background ambient air quality concentrations within the area potentially affected by development of the coal lease and is thus in a position to proceed to the next step of analyzing the impact of the development of the potential lease. Obviously, the impact of the development of a given potential coal lease is a function of the activity which will be associated with the development of that lease. Therefore, the federal land manager must be prepared to make a number of assumptions regarding the ultimate development of that potential lease. These assumptions are included above.

Air Quality Impact Analysis

Tasks

An Air Quality Impact Analysis is required and should include those facilities expected to be constructed and operated as a result of the leasing of the proposed tract plus all other existing facilities in the near vicinity of the tract which also influence the ambient air quality.

- The analysis should project total ambient concentrations of significant pollutants emitted by the facilities to be operated as a result of the proposed lease. These projections should be made both on the lease and in all areas which will receive significant impact due to emissions from the lease (the potentially affected area). Hazardous Air Pollutants (HAPs or air toxics) emitted by projected activities should also be included. HAP impacts should be compared to appropriate EPA and/or state health-based metrics.
- An analysis for Air Quality Related Values (AQRV) including visibility, atmospheric deposition and sensitive lake acid neutralizing capacity (ANC) should also be conducted. This analysis would be done for any Federally

Mandated PSD Class I area (National Park, Wilderness Areas, etc., according to the 1977 Clean Air Act Amendments) within the selected modeling domain. Sensitive Class II areas should also be included if any are located within 100 km of the project area.

- The analysis shall represent the reasonably foreseeable or projected facilities and activities assumed to be associated with the proposed lease.
- The facilities and activities should be appropriately scaled to reflect the assumptions associated with the lease.
- The proposed facilities and activities (plus any existing local facilities) should be modeled using the appropriate EPA approved dispersion models.
- Meteorological data representative of the area should be used in the model.
- The impacts on baseline air quality should be projected for all time periods for which standards have been established for the pollutant of interest.
- Baseline ambient air quality data meeting the data adequacy standards specified above should be used to define baseline conditions to which the projected impact of the proposed facility/activities is added.

A comparison of projected maximum concentrations to applicable Federal and State standards, including PSD increments, is required.

Scope and Intensity

The above tasks are intended to define the data and analyses which are adequate for coal leasing decisions which must be made under most sets of circumstances. However, recognizing that the establishment of such standards can only be accomplished to address the normal or general situations, it is clear that for special circumstances the regional coal team may have to define specific standards for both data adequacy and analysis adequacy when special circumstances or special problems arise for a given lease tract consideration.

Greenhouse Gas Emissions

Tasks

1. Gather information to input into Coal Emissions calculator:
    - Coal mine type: surface or underground
    - Coal production, current and proposed (short tons per year)
    - Depth of coal seam (feet)
    - Fuel use for each engine type (gallons per year)
    - Certified EPA Tier for each engine type
    - Horsepower range for each engine type
    - Topsoil handled (short tons per year)
    - Over-burden handled (short tons per year)
    - Total disturbed area (acres)

- Total paved roads (miles)
- Total unpaved roads (miles)
- Average vehicle weight on paved roads (tons)
- Average vehicle weight on unpaved roads (tons)
- Total number of trips per year on paved roads
- Total number of trips per year on unpaved roads
- Average length of trips on paved roads (miles)
- Average length of trips on unpaved roads (miles)
- Summertime dust control efficiency on unpaved roads
- Average one-way length of coal train trips (miles)

Scope and Intensity

The purpose of the greenhouse gas emission inventory is to provide a general overview of the magnitude of emissions of gases (CO_2, CH_4, N_2O) with the potential to affect global climate, and to provide a reference for reduction of GHG emissions through various potential mitigation measures.

A quantitative GHG analysis over the life of the project must be included in order for the BLM to fulfill its NEPA requirements for analyzing climate change impacts from the proposed action in accordance with BLM and CEQ guidance (December 2014 Draft Guidance).

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CULTURAL RESOURCES

The BLM must ensure that all coal program decisions comply with several cultural resources statutes, executive orders, regulations and agreements including:

Statutes:

National Historic Preservation Act of 1966 as amended (P.L. 89-665; 80 Stat. 915; 16 U.S.C. 470)
The National Historic Preservation Act (NHPA) addresses preservation of the Nation's significant cultural resources. The NHPA established a national preservation program and establishes a process (often referred to as the "Section 106 process") for reviewing federal undertakings to identify and protect cultural resources that are significant on a national, state, tribal, and/or local level.

American Indian Religious Freedom Act of 1978 (P.L. 95-431; 92 Stat. 469; 42 U.S.C. 1996)
The American Indian Religious Freedom Act (AIRFA) protects traditional practices of Native Americans, and is an affirmation of their First Amendment rights. AIRFA protects certain rights such as access to sacred sites, freedom to worship through ceremonial and traditional practices, and possession of sacred objects. AIRFA requires all federal agencies to avoid interference with the practice of Native American religions and to accommodate access to ceremonial and traditional sites.

Archaeological Resources Protection Act of 1979 (P.L. 96-95; 93 Stat. 721; 16 U.S.C. 47Oaa et seq.) as amended (P.L. 100-555; P.L. 100-588)
The Archaeological Resources Protection Act (ARPA) provides for the protection of archeological resources, which are defined as the material remains of past human existence that are of archeological interest and more than 100 years old. The law establishes penalties for the destruction or defacement of archeological sites on federal lands. The law also includes procedures for issuing permits to excavate archeological sites on federal land.

Native American Graves Protection and Repatriation Act of 1990 (P.L. 101-601; 104 Stat. 3048; 25 U.S.C. 3001)
The Native American Graves Protection and Repatriation Act (NAGPRA) requires federal agencies and institutions that receive federal funding to inventory and repatriate Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony in their possession to their respective descendant or cultural group. NAGPRA also establishes a process for repatriation of human remains or funerary objects found on federal lands.

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Executive Orders

Executive Order 11593, Protection and Enhancement of the Cultural Environment
This Order directs federal agencies to inventory their lands for cultural resources and establish policies and procedures to protect, restore, and maintain federally owned sites, structures, and objects of historical, architectural, or archeological significance.

Executive Order 13007, Providing for American Indian and Alaska Native Religious Freedom and Sacred Land Protections
This Order directs federal land-management agencies to accommodate Native American access to and ceremonial use of sacred sites and to avoid adversely affecting the physical integrity of such sites.

Regulations

36 CFR Part 800, Protection of Historic Properties
This regulation identifies processes and procedures for federal agencies to follow to comply with Section 106 of the NHPA.

36 CFR Part 60, National Register of Historic Places
This regulation identifies processes for the identification and evaluation of historic properties for listing on the National Register of Historic Places, and specifies procedures for listing properties on the National Register.

36 CFR Part 63, Determinations of Eligibility for Inclusion in the National Register of Historic Places
This regulation assists Federal agencies in identifying and evaluating the eligibility of properties for inclusion in the National Register.

36 CFR Part 79, Curation of Federally Owned and Administered Archeological

Collections

This regulation defines responsibilities, procedures, and guidelines relating to the curation of material collected in the course of archeological inventory or excavation.

43 CFR Part 7, Protection of Archaeological Resources
This regulation identifies processes and procedures for federal agencies to follow to comply with the ARPA.

43 CFR Part 10, Native American Graves Protection and Repatriation Regulations
This regulation identifies processes and procedures for federal agencies to follow to comply with the NAGPRA.

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43 CFR Part 8365, Rules of Conduct
A portion of this regulation prohibits visitors from willfully defacing, disturbing, removing, or destroying any scientific, cultural, archaeological, or historic resources on public lands.

Existing Agreements, Policy and Standards

Programmatic Agreement among BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers Regarding the Manner in which BLM will meet its Responsibilities Under the National Historic Preservation Act (2012)
This agreement establishes a streamlined consultation process between the BLM, ACHP and NCSHPO and directs state BLM offices to create protocol agreements with individual SHPOs.

BLM Manuals: 8100 - Cultural Resource Management, 8120 - Tribal Consultation Under Cultural Resources, 8130 - Planning For Uses of Cultural Resources, 8140 - Protecting Cultural Resources, 8150 - Permitting Uses of Cultural Resources, 8170 - Interpreting Cultural Resources for the Public
The BLM manuals were created as a supplement to the National PA. The six manuals provide guidance to all aspects of cultural resource management for BLM field offices.

State Protocol Agreement Between the Wyoming BLM State Director and the Wyoming State Historic Preservation Officer (2014)
This agreement is tiered to the national PA and streamlines the section 106 consultation process between Wyoming BLM field offices and the Wyoming SHPO.

Programmatic Memorandum of Agreement Among the Department of the Interior, Bureau of Land Management, Office of Surface Mining Reclamation and Enforcement, and United States Geological Survey, and the Advisory Council on Historic Preservation Regarding the Federal Coal Management Program (1980)
The agreement outlines the roles and responsibilities of BLM, OSM, and USGS related to compliance with section 106 of the NHPA and the federal coal program. The agreement is outdated after numerous changes to statute and regulation since 1980. For example, the USGS is no longer involved in coal leasing since BLM subsumed their responsibilities in 1983. Additionally, the regulations at 36CFR800 have changed significantly. ACHP has recently urged BLM to void or revise the agreement.

Wyoming State Historic Preservation Office Format, Guidelines, and Standards for Class II and III Reports
Buffalo Field Office (BFO) must ensure that each cultural resource inventory report it submits to State Historic Preservation Officer (SHPO) conform to these standards. BFO is legally responsible for any report it submits to SHPO, even if it is authored by a consultant.

Class III Inventory

A Class III inventory report that conforms to the *Wyoming State Historic Preservation Office Format, Guidelines, and Standards for Class II and III Reports* is essentially the "data standard" necessary for:

- The identification of historic properties.
- The identification of sites that may be significant to tribes.
- The consultation between BFO and the Wyoming SHPO.
- The proper application of Unsuitability Criterion 7.
- The completion of any NEPA documentation related to coal leasing.
- The determination of any necessary lease stipulations and/or mitigation requirements.

The NHPA (in particular Section 106 of the statute) requires federal agencies to consider impacts to historic properties (sites that are eligible for, or listed on the National Register of Historic Places) before they issue decisions. Federal agencies are responsible for both identifying historic properties and resolving (typically through avoidance or mitigation) any adverse effects to those properties. The federal coal leasing program is unique because leasing responsibilities lie with the BLM and mine permitting responsibilities lie with the OSM. The two agencies also split the Section 106 compliance responsibilities as defined by a PA between BLM, OSM, USGS and ACHP related to the federal coal management program. The BLM is responsible for identification and evaluation of historic properties within lease areas prior to issuance of the lease, and OSM is responsible for ensuring avoidance or mitigation of historic properties has occurred prior to approval of a mine plan. In Wyoming, OSM has delegated much of this responsibility to WY DEQ.

The primary constituent of BLM compliance with Section 106 involves on-the-ground inventory in order to locate historic properties. The regulations at 36CFR800.2 (a)(3) state "…the agency official may use the services of applicants, consultants, or designees to prepare information, analyses and recommendations under this part. The agency official remains legally responsible for all required findings and determinations." BFO has historically relied on coal leasing applicants to provide Class III inventory reports created by consultants. As defined in BLM Manual 8110, a Class III inventory is an intensive, on the ground survey that, "…describes the distribution of properties in an area; determines the number, location and condition of properties; determines the types of properties actually present within the area; permits classification of individual properties; and records the physical extent of specific properties." Class III inventory reports are used by BFO as legal documents to consult with the Wyoming SHPO, and all Class III reports must comply with the Wyoming SHPO Class III Report Standards.

Primarily due to a lack of clear and consistent guidance from BFO, several concerns related to Class III inventories performed by consultants and BFOs section 106 compliance responsibilities have emerged:

- A lack of communication between BLM, applicant and the consultant prior to the initiation of work has led to submittal of inventories that do not adequately cover the project area, or cover too much of the project area.

- Certain previously accepted inventories are not up to current standards and cannot be relied upon by BFO as adequate previous inventory, although applicants and consultants may mistakenly assume they are adequate.
- In many cases, BFO did not evaluate all sites within an inventory area prior to signature of coal leasing RODs.
- In certain cases BFO may not have (as stated in 36CFR800.4(a)(4) " Gather(ed) information from any Indian tribe… to assist in identifying properties, including those located off tribal lands, which may be of religious and cultural significance to them…" prior to making determinations of eligibility.

These issues have led to delays in the issuance of coal leasing decisions, the application of restrictive lease stipulations and difficulty on the part of OSM, WY DEQ and lease holders in the mine permitting phase. In order to avoid these issues with future LBAs, BFO is taking a more proactive approach as described in the table below:

Prior LBAs	New LBAs
Applicants often hired consultants to perform inventory many years before the submittal of an LBA. BFO did not have an active role in defining areas needing inventory, determining whether previous inventories were adequate, or in determining if certain sites needed to be evaluated or re-evaluated.	BFO will perform all files searches and inform the applicant of all required work when the LBA is submitted. BFO will not approve cultural resource fieldwork requests from consultants related to LBAs before an application is received by BFO from the Casper FO coal team.
BFO received inventory reports that typically did not match the LBA as defined by the Casper FO coal team.	BFO will define the inventory and site evaluation parameters for applicants. If BFO cannot perform the inventory, it will inform the applicant, who can then retain the services of a consultant.
The completion of a Final EIS for an LBA was not coordinated with BFOs section 106 compliance responsibilities. Section 106 compliance was often completed after issuance of the Final EIS and immediately prior to the signature of the ROD, or occasionally deferred until after the ROD was signed.	BFOs section 106 compliance responsibilities will be completed prior to the issuance of the Draft EIS.
Coal leases containing unevaluated sites were awarded.	BFOs section 106 compliance responsibilities (identification and evaluation of historic properties) will be completed prior to the issuance of the Draft EIS.
Native American consultations may not have been completed by BFO for certain sites prior to leasing decisions.	BFOs section 106 compliance responsibilities (including Native American consultations) will be completed prior to the issuance of the Draft EIS.

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Class I Inventory\Files Search

Coal project applicants occasionally supply BLM with what is phrased as a "Class I inventory". There is a distinct difference between a "Class I inventory" and a files search. A Class I Inventory is defined in BLM Manual 8110 as, "…a comprehensive view of all the known archaeological, historic, cultural and traditional places within a large area, such as the area to be covered by a land-use plan…" Class I inventories are typically all-encompassing documents that are associated with field office wide resource management plans rather than specific projects. Licensing coal exploration or permitting LBAs do not meet the threshold for creating a Class I inventory and there are no circumstances where BFO will require or request a Class I inventory associated with these types of projects. In contrast to a Class I inventory, a files search is an expedient analysis of existing data performed in order to determine if certain areas have been inventoried and if historic properties are present. The "Class I Inventory" reports that BFO received in the past are more accurately described as simple files searches. BFO has no need for a document from a consultant that only describes a files search. Rather than having a consultant perform this work, BFO cultural resource staff will conduct file searches for all coal related project proposals to determine the cultural resource inventory needs. BFO cultural resources staff can provide all pertinent information derived from files searches to applicants within three business days of an applicant's request. This information includes the adequacy of previous inventories, site eligibility determinations and the need and scope for further work as determined by the BLM.

Data Standards for Cultural Resources

- Coal Exploration Licenses:

  BFO cultural staff will require a map of the proposed drill locations and accesses from the applicant in order to perform a files search. This map should be sent to BFO at the same time the application is submitted to the Casper FO coal team. Electronic data is preferable if it is, or can be converted to, shape file data. Within three days of receiving the map information, BFO will provide the applicant with the results of a files search outlining any additional inventory needs. Depending on workloads, BFO staff may be able to perform inventory. If BFO cannot perform the inventory in a timely manner, the applicant will be notified when they get the files search results. If BFO cannot perform the inventory, the applicant may provide a contracted inventory. All contracted Class III inventories must conform to the Wyoming SHPO Class III Report Standards.

  Required Data from Applicant: BFO will require the same map data that is provided to the Casper FO coal team when the exploration license is applied for. The applicant will be notified of the need for any additional work.

- LBAs:

  BFO cultural staff will receive a copy of the LBA map from the Casper FO coal team when it is submitted to BLM. Applicants are cautioned not to have consultants perform inventory before speaking with the BFO cultural staff since LBA boundaries may be

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modified by the Casper FO coal team after submittal. When the BFO cultural staff receives a map from the Casper FO coal team, they will perform a files search for general analysis area of the LBA (LBA with a ¼-mile buffer, excluding areas within existing mine permit boundaries). Previously accepted inventory reports that do not conform to current standards may need to be field verified or re-surveyed. Any portions of the general analysis area that do not have adequate inventory must be inventoried. Any unevaluated sites within previous adequate inventory in the general analysis area must be evaluated. Depending on workloads, BFO staff may be able to perform inventory and site evaluations. If BFO cannot perform the inventory, the applicant will be notified and the may provide a contracted inventory. All contracted Class III inventories must conform to the Wyoming SHPO Class III Report Standards.

Required Data from Applicant: None, BFO will get the necessary data from the Casper FO coal team once the LBA is applied for. The applicant will be notified of the need for any additional work.

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SOCIOECONOMICS

These economic and social data adequacy standards are intended to fulfill socioeconomic requirements contained in NEPA and CEQ as well as those contained in the Federal Coal Leasing Act Amendments (FCLAA). Judge Battin's Memorandum Opinion of May 1985 (the Northern Cheyenne Tribe versus Donald Hodel, Secretary of the Interior) ~ also provides direction on various socioeconomic aspects of Interior's responsibilities as they relate to socioeconomic analysis. These standards are intended to satisfy those responsibilities as well. There may exist special economic and social circumstances at the county, community, and Reservation level that could require special attention. Identification of those circumstances will occur during the scoping process associated with activity planning. These economic and social data adequacy standards provide for the collection of a broad spectrum of data that, once collected, will enable the BLM to analyze those special conditions in appropriate detail.

Economic and social impacts associated with the development of federal coal occur primarily as a result of employment from construction and operation of coal mines and any associated coal conversion facilities (e.g., coal-fired electric generators, synthetic fuel plants). Western strip mines are frequently found in remote areas with relatively sparse population. Consequently, the demand for labor in this type of situation (especially during the labor intensive construction phase) usually far exceeds the available supply. These conditions can result in workers and their families moving into the area to take advantage of employment opportunities. Rapid growth in population can result in severe impacts to housing, public services (especially schools, water, sewage, police, fire, and health systems), wholesale/retail outlets and the general level of social well-being. Some communities are better prepared than others to handle these impacts, depending on their past experience with growth, level of excess public service capacity, and their financial ability to respond to the demands from rapid population growth.

<u>Tasks</u>

The following tasks are necessary to develop the range of socioeconomic information needed for activity planning in the Powder River Region:

- Collect input/output data
- Input/output computer modeling
- Develop gravity model
- Complete gravity computer modeling
- Complete population apportionment in consultation with local experts
- Coordinate with state, ' federal, and local experts in development of public service adequacy standards
- Develop public service cost estimators
- Collect and analyze information on community resources (i.e., history of development, cultural characteristics)
- Collect and analyze information on community social organization

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- Analyze the ability of communities to absorb incoming population based on community resource and community social organization information.

Scope and Intensity

The analysis of economic and social impacts in the Powder River Region will initially focus on those locations expected to experience coal related population growth. However, counties/communities/Indian Reservations that do not directly experience employment or population growth could still be affected by nearby development. For that reason, analysis is warranted to determine the nature and extent, if any, of significant local impacts which could result from population growth elsewhere in the Region.

Considerable coordination is required among the BLM economic and social analysts, Montana and Wyoming state governments, other federal agencies (including BIA), local, state, and Northern Cheyenne and Crow Tribal experts, city/county planners, and any other individuals/organizations that can provide information regarding socioeconomic · conditions at the community and county level.

The following are proposed economic and social data acquisition techniques and analytical approaches for the Powder River Region:

1. Baseline employment forecasts as well as impact forecasts, by alternative, of employment changes at the Regional level will be developed through input/output modeling. Assumptions will then be developed regarding the percentage of regional labor supply which would be available locally vs. the amount which would in-migrate to the Region in response to job opportunities. A gravity model will be used to apportion incoming employees to Montana and Wyoming communities in the study area. Population estimators (e.g., average family sizes of incoming construction and operation workers who are married and bring families with them, etc.) would be developed and applied to the estimates of incoming workers to provide total population changes in the Region for baseline and impact scenarios at the community level. Gravity modeling will provide a documented process for apportionment of in-migrating workers and families to the Region's counties and communities.

   Model-generated employment/population numbers will be forecasted at the community level. BLM would utilize the expertise of those individuals who are best suited to determining the range of local factors which would influence incoming workers' choice of residence (e.g., road conditions, community size, recreational opportunities, shopping availability, school conditions, local planning, etc.). Examples of local experts would include city and county planners, mayors, local administrators, Tribal/BIA experts, and any other knowledgeable individuals or organizations in the Region.

2. Baseline and impact public service adequacy ratings will be developed at the local level. This analysis would focus on the adequacy of those services necessary for maintaining public health and safety:

- Sewage treatment
- Water storage and distribution systems
- Health care
- Schools
- Police protection
- Fire protection.

Much of the information needed to assess and analyze service adequacy (current and forecasted adequacy. both with and without federal coal development) would be obtained from local experts, state infrastructure specialists. BIA/Tribal experts and any other knowledgeable persons/organizations in the Region. Localities with excess service capacity (under baseline and/or impact scenarios) would be noted. Service adequacy will be discussed qualitatively in cases where quantified service data is not available.

3. Estimated revenues and expenditures:

   - Forecasts will be developed at the local level of major baseline and impact expenditures necessary to provide adequate public services in instances where services would fall short of those necessary for provision of basic health and safety. This would require use of regional service adequacy standards and of public service "cost estimators" for the Region.

     Forecasts would be developed at the local level of significant revenues generated by mineral development (e.g., taxes on mineral extraction and conversion and on mines/facilities). An estimated net fiscal balance would be developed for those revenues and expenditures which are forecasted.

   - Changes in federal coal royalty revenues to state government would be estimated based on federal tonnages expected mining rates, and assumed royalty rates.

   - Changes in state severance taxes flowing back to Montana and Wyoming communities (i.e., funds which are available for local impact assistance) would be forecast based on appropriate state severance tax laws and mining rates.

4. Total payroll and company expenditures would be estimated during construction and operation phases. These would be used to examine the regional economic effects from proposed federal coal development. This would be accomplished primarily via input/output modeling.

5. Agricultural impacts would be analyzed in terms of the changes in crops and/or livestock production and value that are directly attributable to the proposed action.

6. Community social conditions would be examined using the methodology developed in the BLM *Guide to Social Assessment*. The methodology proposes a framework of factors that contribute to a community's ability to absorb change. The "Affected -Environment"

and "Environmental Consequences" sections would utilize the overall framework found in the *Guide*.

Summary of Data Needs

1. Summary of Economic Data Elements

Data Elements	**Scenario**	**Level**
Employment	Baseline & Impact	Region, County, Reservation
Population	Baseline & Impact	Region, County, Community, Reservation
Service Adequacy	Baseline & Impact	County, Community, Reservation
Revenues & Expenditures	Impact	Region, County, Reservation
Income	Baseline & Impact	Region
Agriculture	Impact	Region, County

2. Summary of Social Data Elements

The *Guide to Social Assessment* provides a list of factors that contribute to community level capacity to absorb change. Using the Guide, the analyst would determine which of the factors would be most relevant to the situation and would focus on those factors that are determined to be most relevant. A complete list of factors includes:

- Community Resources
    - History of development
    - Cultural characteristics
    - Demographics
    - Labor force size and diversity
    - Employment and income characteristics
    - Relative availability of facilities and services; fiscal resources
    - State and local regulations
    - Experience of local leadership
    - Local attitudes
- Community Social Organization
    - Economic, social and political diversity
    - County and community linkages to nonlocal organizations
    - Intergovernmental coordination
    - Patterns of personal interaction
    - Distribution of resources in the community
    - Intracommunity coordination and cooperation
- Levels of Social Well-Being Within the Community

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Local social consequences of each alternative would be examined for affected communities. Findings from the "Affected Environment" chapter of the *Guide to Social Assessment* would be used in concert with population projections from the economic section to describe all significant, expected social changes at the community or Reservation level.

It is expected that the social analysis, as in the economic analysis, will initially focus on those communities that are forecasted to experience coal-related population growth. Analysis of social conditions would be expanded beyond those communities when appropriate.

References

A variety of primary and secondary sources would be used for the economic and social analyses. This includes: private research reports, company reports, federal, state and local studies and/or EISs, official Census Bureau and employment documents, special censuses, city/county comprehensive plans, socioeconomic data and/or reports or studies done by or for the Crow or Northern Cheyenne or by BIA.

An integral part of the economic and social analysis is the BLM-funded *Social and Economic Study of the Effects of Coal Development on the Northern Cheyenne Tribe (May 1986).* It is designed to analyze the recent historical consequences to the Northern Cheyenne Reservation, the Tribe, and its members, of existing off-Reservation coal development in southeastern Montana. The study will also describe the jurisdictional and cultural differences between the Tribe and its members and off-Reservation communities and residents in the Region. In addition, it is intended that the study will clearly portray any special circumstances which exist on the Reservation regarding provision of and funding for public services. The results will provide the foundation of the social analysis pertaining to the Northern Cheyenne Reservation and people. Additionally, the contractor who performs this work will assist BLM in its population apportionment efforts regarding the Northern Cheyenne Reservation, Tribe, and its people.

Socioeconomic conditions on the Crow Reservation have been documented in the three volume *Decker Area Mines Comprehensive Social Sciences Study*, 1983. That report, prepared for the Montana Department of State Lands and the U.S. Office of Surface Mining, provides a foundation for socioeconomic and cultural baseline and impact analysis of possible impacts to the Crow Reservation.

Also included as sources would be any other current primary data collection effort, and/or studies such as, *The Economy of Eastern Wyoming*, 1983. Local and Tribal experts are especially valuable sources regarding infrastructure and public finance information; they would be asked by the BLM to provide service-specific adequacy information and overall budgetary data, among other things.

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VEGETATION AND LAND USE

Existing vegetation communities, species composition and relative abundance of species in each community must be determined in each proposed coal lease tract. Existing land uses on all proposed tracts must also be known before leasing decisions can be made. The reclamation potential for each proposed tract must be adequately assessed prior to leasing. The following data requirements and data standards (together with data requirements found in the soils, geology, hydrology, and wildlife sections of this document) are a guideline to provide the BLM with adequate information to rank proposed tracts of land for leasing and development of coal reserves with regard to vegetation and land use.

Tasks

1. Identify plant species in each tract
2. Delineate and describe vegetation communities
3. Determine presence/absence of threatened, endangered or undetermined status plant species.
4. Identify existing farmlands
5. Determine livestock carrying capacity
6. Determine reclamation potential
7. Identify existing rights-of-way
8. Delineate existing railroad or other transportation systems in or near the proposed tracts
9. Identify any other land use; recreation sites, commercial timber, paleontological sites, cemeteries, defense installations, etc., that would or could be disturbed by mining.
10. Identify any existing or proposed commercial and residential developments in or near proposed lease tracts which could be affected by coal gas from future mining operations.

Scope and Intensity

1 and 2: Existing vegetation surveys should be utilized and new vegetation inventories should be conducted to delineate vegetation communities (based upon 2 or more dominant species) in each tract. Vegetation surveys for these tracts should be reviewed, and revised as necessary, at five-year intervals. All discrete plant communities should be mapped at a scale of up to 1:24,000 using soil survey maps or other appropriate maps. All plant species present in each tract, as well as relative abundance (based on cover, production and/or frequency) must be noted. Community descriptions should include information on relative abundance of major life forms (deciduous and coniferous trees, shrubs, grasses, and forbs).

Species (and abundance) data will be used to aid in addressing: type and extent of wildlife habitat, range condition and carrying capacity, and other agronomic and silvicultural aspects of plant materials in each tract. Documentation of sampling methodologies used (i.e., random sampling, stratified random sampling, ocular estimation techniques, size and shape of quadrats or other sampling devices used, community delineation criteria, number of samples-Leo sample adequacy, etc.) must be incorporated in the narrative description of the plant communities in each tract. Care must be taken to select sampling methodologies that reflect the species composition and relative abundance of the vegetation in the tract as accurately and

comprehensively as possible. These steps will provide for accurate interpretation of data and for consistency in future data collection efforts (3,4,6).

3: The species list obtained in meeting the requirements of tasks 1 and 2 must be compared to an appropriate list of threatened, endangered, or undetermined status (TEUS) plant species. An assessment of the potential to isolate areas harboring TEUS plant species form theoretical mining activities, as well as preliminary assessment of potential for reclaiming areas that could support TEUS plants in a post-mine landscape, must be made.

The comparatively intense field survey would be most appropriately conducted during the flowering season of TEUS plant species that may potentially be present in the tract. After the initial vegetation inventory is completed, additional cursory reconnaissance could be conducted throughout the sampled year to best determine presence/absence of TEUS plant species. Reconnaissance should be concentrated on habitats that could potentially harbor TEUS species.

A description of the topography within the tract is necessary. Delineate any unique areas (bench tops, buttes, steep canyons, etc.), including any area in which vegetation is inaccessible to livestock. The above areas may be important "natural areas" and may not be reclaimable. Riparian zones, springs and moist areas should be closely scrutinized. These sites may also harbor TEUS plant species (1, 2, 5).

4, 5, 6: Presence or absence of cropland, actual or potential prime farmlands, and alluvial valley floors (AVF) must be determined. If these lands are present; areal extent, type of crops present, annual production, significance to agricultural operations, and volume of suitable soil and spoil available for reclamation must be determined and delineated. Significant AVFs are precluded from mining. A preliminary determination must be made regarding the technological feasibility of restoring disturbed (non-significant) AVFs or prime farmlands to equivalent or higher crop yields as compared to pre-disturbance lands must be made. Irrigated and dryland farming areas can be determined for each tract using color, black and white, and-or infrared aerial photos, ASCS records and personal contact with the farm operator. These same sources are also useful for identifying the type of crops grown on each tract. Crop yields can be determined using the agricultural statistics developed by each state agriculture department, ASCS Federal Crop Insurance Records, county tax records, or by direct measurement. Additionally, soil capability ratings for soil survey areas are published by USDA-NRCS.

Ecological site and carrying capacity can be determined for all acreage within each tract using the vegetation survey in conjunction with USDA-NRCS Ecological Site Descriptions and state and transition model, Natural Resource Conservation Service soil surveys, aerial photos, BLM RMP/EIS grazing documents, etc. Livestock carrying capacity may best be determined using the ecological site descriptions. This method correlates livestock forage produced on each ecological site and plant community to livestock carrying capacity (animal unit months (AUMs) per acre).

Other questions that must be answered in a pre-lease ranking of tracts include: Is there a potential physical, chemical, biological or environmental issue that would preclude establishing a permanent, diverse vegetative community capable of supporting a post-mine land use for

livestock and wildlife? Would any characteristic of the tract preclude reestablishing productive agricultural areas? What is the probable quality and quantity of the reclaimed area root zone medium? All drill hole data should be closely scrutinized and appropriately composited to make a preliminary assessment of post-mine root zone quality and quantity. Specifically, what are the projected soil and spoil chemical and physical characteristics from the surface to at least 8 feet below the reclaimed surface? The probable mining and material handling methods to be used should also be considered in the assessment of reclamation potential. Information gleaned in tract analysis with regard to soil and overburden, hydrology, geology, wildlife and economics, as well as vegetation will be useful in answering these questions (7, 8, 9, 11, and 12).

7 and 8: Existing records from utility companies serving the region must be examined for rights-of-way crossing potential lease tracts. Of particular concern in the Powder River region are linear rights-of-way for roads, telephone, power and pipelines. BLM MT plats, appropriate maps, consultation with utility companies and private surface owners, etc., will serve to identify rights-of-way. Potential impacts to these rights-of-way as well as possible mitigations of these impacts must be addressed and documented.

As most of the coal produced in this region is exported, the existence or lack thereof, of suitable transportation facilities becomes important. Transportation related assessments should address potential impacts to property owners and the environment, as well as addressing transportation in relation to potential for mine development. Personal knowledge of existing railroad lines, pertinent maps, industry's intentions state in expressions of interest, and public input will provide necessary information to make this analysis and comparison (10).

9: All existing land uses on a tract must be determined. The potential impact of mining and the reclamation potential regarding each of these uses must be assessed and documented. These land uses may include but are not limited to: recreation sites, commercial timber, paleontological sites, cemeteries, defense installations, and historic sites. USGS topography maps, State/U.S. Department of Transportation County, Maps, Federal and State land resource documents (BLM land use planning documents, regional EISs, etc.) may be useful in this regard.

10: Potential impacts to existing and future developments include coal gas problems, noise, visual intrusions, and other adverse impacts. Development data is essential to avoid such problems.

Presence or absence of commercial timber must be determined. A preliminary assessment of the likelihood of reestablishing commercial timber in a post-mine situation should be included in the tract assessment/ranking. Commercial timber exists if the tract or part of the tract is capable of producing at least twenty cubic feet of industrial wood under management. The following data are important for categorizing commercial timber: species, age of stand, density by age class, diameter at breast height, height, growth rate, condition (insect infestation, disease, etc.), accessibility, topography, and transportation availability.

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Soil Conservation Service, 1980 (and as revised through 1984), *Technicians Guide to Range Sites and Condition Classes*, U.S. Department of Agriculture, MT-MLRA-58-l0-MT, WYO, NO, SD.

State of Montana, Department of Highways/U.S. Department of Transportation, Federal Highway Administration, 1980, Montana County Maps.

State of Montana, Department of State Lands, 1980, *Montana Strip and Underground Mine Reclamation Act. Rules and Regulations*.

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GEOGRAPHIC INFORMATION SYSTEM (GIS) DATA SUBMITTAL

GIS data submitted for projects should be in a format compatible with the BLM Wyoming geographic information system. Acceptable formats are:

- ESRI ArcGIS Version 10 shapefile or geodatabases (preferred)
- AutoCAD .dwg or .dxf files

Geospatial data must describe the location of features as follows:

- Geographical coordinates should be referenced to the Transverse Mercator (UTM) projection, Zone 13 North, North American Datum 1983.
- Geospatial vector and raster data must include appropriate attributes.
- Complex attributes shall be delivered in a well-structured relational database format. Map features and database records should share a common unique identifier or primary key that relates the map feature to the table record.
- Images or aerial photography must be georeferenced.
- All coincident points on external boundaries will have the same coordinate values; i.e., boundary lines will be edge-matched.
- Use or distribution constraints should be included in the metadata.
- Geospatial data collected for the project must include the following attributes at a minimum:
    - Collection date
    - Data capture method (i.e., GPS, digitizing, etc.)
    - GPS equipment used
    - Estimate of mapping accuracy

Geospatial data must conform to any resource-specific accuracy standards. For example, cultural inventory data must meet State Historic Preservation Office (SHPO) standards.

AutoCAD files:

- Only CAD layers that will be of interest for GIS analysis of the project should be included; i.e., do not include annotation, dimension arrows, borders.
- CAD drawing files (.dwg) should include a projection file for georeferencing the data.
- CAD export files (.dxf) should include georeferenced coordinates, preferable UTM (as noted above).
- If drawings do not have a standard coordinate system, reference ties to the public land survey system must be included so that drawings can be georeferenced.
- All blocks should be exploded prior to creation of the .dxf file.
- Drawings should contain text in standard fonts that can be read without third-party software.

Inventories based on existing geographic features should conform to National Spatial Data Infrastructure (NSDI) datasets:

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- Watershed and hydrographic features: USGS National Hydrography Dataset
- Wetlands: U.S. Fish & Wildlife Service National Wetlands Inventory
- Soils: NRCS Soil Survey Geographic Database (SSURGO)
- Public Land Survey: BLM Geographic Coordinate Data Base

All hard-copy maps that are submitted must:

- Be of a scale no smaller than 1:24,000, unless otherwise stated for particular resources.
- Township and range must be shown on all maps.
- BLM standard colors should be used for public land ownership (see http://www.blm.gov/nstc/mapstandards/colormod.html for mapping standards).

Data may be submitted in uncompressed or compressed (WinZip) format:

- On a compact disk or DVD
- Via file transfer protocol (FTP) site

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Comment Responses From Original Document Release		
Source	**Comment**	**Response**
Socioeconomics		
Northern Plains Resources Council	Standards must be parallel Judge Battin Decision	First paragraph contains a specific reference to Judge Battin's decision and its use in decision making
Northern Cheyenne Tribe (Steve Chestnut, Atty.)	Standards need to be more specific to Northern Cheyenne Tribe	Text is revised to clearly show analysis of Northern Cheyenne and Crow Reservations as distinct entities.
Geology		
Loren Williams Northern Plains Resources Council	Clarify drill hole densities Agreed With Standards. Some clarification needed	Clarified in text Text clarified
Soils		
Loren Williams	Clarify Drill Hole Densities.	Text rewritten to clarify and be more specific
Hydrology		
Wyoming Game and Fish Department	References to Wyoming stream fishery classification map needed to be added. Adequacy of existing data should be determined as well as the need for additional data.	Reference added. See discussion at the end of the "Tract Classification"; the determination of additional data needs is discussed there.
Powder River Basin Resource Council	Standards should set guidelines on how mining will affect water allocation to surrounding landowners.	The allocation of water rights is an adjudicative function of each state and is beyond the scope of these data adequacy standards.
American Mining Congress	Standards are excessive	Standards were not changed. The levels of data and analysis called for are necessary for making informed leasing decisions.
State of Wyoming	Standards are excessive	See previous response.
Northern Cheyenne Tribe	No mention of Northern Cheyenne water rights	Water Rights are adjudicated by the individual states and are beyond the scopes of the data adequacy standards. This does not imply however the water rights claims could not be considered in an EIS.

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Wildlife		
Wyoming Game and Fish Department	Text specific clarification	Text revised to reflect comment.
Northeastern Wyoming Wildlife Association	Inventories for big game, raptors and game birds should include 6 seasons rather than 4.	Four seasons of inventory is the minimum agreed to. The text provides for determining the need for the additional inventory if conditions warrant.
Powder River Basin Resource Council	Same Comment as above	Same Response as above.
Air Quality		
Northern Cheyenne Tribe (Steve Chestnut)	No mention of Class 1 Air on Northern Cheyenne Reservation	Ambient air quality data adequacy standards are sufficient to apply to PSD Class 1 considerations. Comparison of impacts to applied on a case-by-case basis depending on individual state and federal standards, PSD Class 1 areas included.
State of Montana Air Quality Bureau	Add other pollutants such as organics, odors, and H2S. Need to include PSD increments to applicable.	Depending upon development scenarios the list of measured pollutants may need to supplement. Text is revised to include PSD increments.
State of Montana Department of State Lands	Why is a year's worth of air quality data needed to make leasing decisions?	The accepted practice and requirements in the case if PSD is one year of data to establish a baseline. There likely is historical data available in the area of interest which would acceptable.
Cultural Resources		
State of Montana Department of State Lands	Why is BLM suggesting a second Class I inventory?	Commenter apparently misread the section on Class I inventory. This section explains how existing Class I inventories can be used.

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Vegetation and Land Use		
Northern Plains Resource Council	Expand analysis to include off-site impacts.	Text revised to include significant operations of lands in each tract.
State of Montana Department of State Lands	Strengthen Reclamation section.	Text revised to include reclamation and vegetation. Also see soils and hydrology sections.
State of Montana Department of State Lands	Determine Potential T&E plants and communities.	Text revised, T&E discussion included.

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