

## CHAPTER 4

### MITIGATING MEASURES

#### INTRODUCTION

The discussion and analysis of effectiveness for requirements which would reduce impacts resulting from mining and reclamation on the Buckskin site are presented in this chapter. There are two categories of requirement which would bear on this project.

The recent enactment of the Surface Mining Control and Reclamation Act of 1977 (SMCRA) and promulgation of regulations (Title 30 CFR Part 700) to implement the act require the mine permittee (Shell Oil Company) to revise and resubmit the mining and reclamation plan. The revisions are necessary to bring the plan into compliance with SMCRA. The first category of requirement (SMCRA performance standards) represents an effort to anticipate the performance standards of SMCRA which require revisions in the plan. To the extent possible, the performance standards are analyzed for their general effectiveness in relieving specific impacts on the Buckskin site. Regulations cited were published in final form in December 1977.

The second category of requirement (committed measures) includes all those measures which are real, committed, and will be enforced. An analysis of the effectiveness of each committed mitigating measure is also included in this discussion.

Table BU4-1 at the end of this chapter summarizes the effectiveness of both categories of requirement, and the impact remaining after mitigation (residual impact).

#### SMCRA PERFORMANCE STANDARDS

##### Postmining Use of Land (30 CFR 715.13)

All disturbed areas shall be restored in a timely manner to conditions that are capable of supporting the uses which they were capable of supporting before any mining or to higher or better uses if approved by the regulatory authority.

It appears from the calculations presented in Tables BU3-6 through BU3-8 that long-term soil productivity (and hence vegetative productivity) would eventually stabilize at 94% of premining levels on the Buckskin site, unless some modification of the reclamation plan raises the productivity. The methodology used to calculate this productivity is explained in Chapter 2, Soils, of the regional analysis. Although the methodology has not been verified on mined lands, it has been used successfully to

predict productivity on lands reclaimed from other types of disturbance.

Presently, 121 acres of the Buckskin site are, or have been in the past, used as cropland. Under the present plan, these would be reclaimed as rangeland. An evaluation will be required to determine whether this sort of conversion would be allowed as an approved postmining land use.

##### Backfilling and Grading—Thin Overburden (30 CFR 715.14(g))

In surface coal mining operations carried out continuously in the same limited pit area for more than 1 year where the volume of all available spoil and suitable waste materials is demonstrated to be insufficient to achieve approximate original contour, surface coal mining operations shall be conducted to meet, at a minimum, the following standards:

(1) Transport, backfill, and grade, using all available spoil and suitable waste materials from the entire mine area, to attain the lowest practicable stable grade, which may not exceed the angle of repose, and to provide adequate drainage and long-term stability of the regraded area.

(2) Eliminate highwalls by grading or backfilling to stable slopes not exceeding 50% or such lesser slopes as the regulatory authority may specify to reduce erosion, maintain the hydrologic balance, or allow the approved postmining land use.

(3) Transport, backfill, grade, and revegetate to achieve an ecologically sound land use compatible with the prevailing land use in unmined areas surrounding the permit area.

(4) Transport, backfill, and grade to ensure that the impoundments are constructed only where it has been demonstrated to the regulatory authority's satisfaction that all requirements of  $\kappa$  715.17 have been met and that the impoundments have been approved by the regulatory authority as meeting the requirements of this part and all other applicable federal and state regulations.

On the Buckskin site, overall lowering of the mined area and differential settlement could cause shallow ponding, peripheral gullying, changed drainage patterns, and other attendant impacts.

The shallow ponding would result from a general lowering of the reclaimed surface toward the water table level. Shallow ponding would affect the surface hydrologic system, and thereby affect the postmining land use

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for agriculture and wildlife. These impacts would be minimized by reconstructing the natural slopes as closely as possible; replacing the original contour and configuration of the natural drainage pattern as closely as possible; and compacting the backfill of the replaced valley floor which carries the new main stream channel. Sufficient extra overburden should be placed on top of the lowest areas of replaced overburden so that the stabilized contours after settlement are near those shown on the post-mining contour map.

### Topsoil Handling (30 CFR 715.16)

To prevent topsoil from being contaminated by spoil or waste materials, the permittee shall remove the topsoil as a separate operation from areas to be disturbed. Topsoil shall be immediately redistributed on areas graded to the approved postmining configuration. The topsoil shall be segregated, stockpiled, and protected from wind and water erosion and from contaminants which lessen its capability to support vegetation if sufficient graded areas are not immediately available for its redistribution.

On the Buckskin site, a reduction in quality would occur in stockpiled topsoil due to unavoidable erosion and loss of native seeds, microorganisms, organic matter, nutrients, and vegetative propagules. Accidental spillage of oil, gas, or other toxic materials would contaminate small amounts of soil, but such spillage would be localized and of little relative significance.

As long as there are only 25 inches of "topsoil" material present on the site as indicated in Table BU3-6, any soil amendments such as fertilizer or organic matter can only result in a temporary increase in productivity. If a greater depth of "topsoil" material were replaced, such as 30 inches, along with the appropriate soil amendments, the long-term productivity of the site should equal or exceed the premining productivity.

If a major flood occurs, such as a 25-, 50-, or 100-year flood, when topsoil material is exposed, accelerated unquantifiable erosion would occur which would result in large amounts of soil loss. (See also Committed Measure (F) below.)

Realistically, soil protective measures are not likely to be more than 90%-95% effective in protecting topsoil.

### Protection of the Hydrological System (30 CFR 715.17)

The permittee shall plan and conduct coal mining and reclamation operations to minimize disturbance to the prevailing hydrologic balance in order to prevent long-term adverse changes in the hydrologic balance that could result from surface coal mining and reclamation operations, both on and offsite. Changes in water quality and quantity, in the depth to groundwater, and in the location of surface water drainage channels shall be minimized such that the postmining land use of the disturbed land is not adversely affected and applicable federal and state statutes and regulations are not violated. The per-

mittee shall conduct operations so as to minimize water pollution and shall, where necessary, use treatment methods to control water pollution. The permittee shall emphasize surface coal mining and reclamation practices that will prevent or minimize water pollution and changes in flows in preference to the use of water treatment facilities. Practices to control and minimize pollution include, but are not limited to, stabilizing disturbed areas through grading, diverting runoff, achieving quick-growing stands of temporary vegetation, lining drainage channels with rock or vegetation, mulching, sealing acid-forming and toxic-forming materials, and selectively placing waste materials in backfill areas. If pollution can be controlled only by treatment, the permittee shall operate and maintain the necessary water-treatment facilities for as long as treatment is required.

Specifically, 30 CFR 715.17 provides for protection of the hydrologic system by establishing requirements for:

- water quality standards and effluent limitations,
- surface water monitoring,
- diversion and conveyance of overland flow away from disturbed areas,
- stream channel diversions,
- sediment control measures,
- discharge structures,
- handling of acid and toxic materials,
- minimizing and monitoring effects on ground water recharge, flow, and quality,
- replacement of water supplies affected by mining operations,
- preservation of essential hydrologic functions of alluvial valley floors throughout the mining and reclamation process,
- permanent impoundments, and
- hydrologic impacts of roads and other transport facilities.

For alluvial valley floors, such as that identified on the Buckskin Mine site, the regulations require that surface coal mining operations conducted in or adjacent to alluvial valley floors shall be planned and conducted so as to preserve the essential hydrologic functions of these alluvial valley floors throughout the mining and reclamation process. These functions shall be preserved by maintaining or reestablishing those hydrologic and biologic characteristics of the alluvial valley floor that are necessary to support the functions.

Also, surface coal mining operations located west of the 100th meridian west longitude shall not interrupt, discontinue, or preclude farming on alluvial valley floors and shall not materially damage the quantity or quality of surface or groundwater that supplies these valley floors unless the premining land use has been undeveloped rangeland which is not significant to farming on the alluvial valley floors or unless the area of affected alluvial valley floor is small and provides negligible support for the production from one or more farms.

Also, before surface mining and reclamation operations may be issued a new permit, the permittee shall submit, for regulatory authority approval, detailed surveys and baseline data from which the degree of material damage to the quantity and quality of surface and groundwater

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that supply the alluvial valley floors may be assessed. The surveys and data shall include (a) a map, at a scale determined by the regulatory authority, showing the location and configuration of the alluvial valley floor; (b) baseline data covering a full water year; (c) plans showing how the operation will avoid, during mining and reclamation, interruption, discontinuance, or preclusion of farming on the alluvial valley floors and will not materially damage the quantity or quality of water in surface and groundwater systems that supply such valley floors; (d) historic land use data for the proposed permit area and for farms to be affected; and (e) such other data as the regulatory authority may require.

On the Buckskin site, degraded land use and water quality downstream from the mine site from erosion and leachate from removed overburden may be totally mitigated through planting vegetation on soil storage piles and use of temporary diversions to impoundments. Velocities in bypasses which would be higher than those normally traversing the area in the natural stream may be mitigated by vegetating and roughening the channel. (This, however, decreases the efficiency of the bypass and defeats its purpose of diverting flood flows around the mine in the most expeditious manner.) Any effect higher water velocities might have farther downstream would probably be dissipated in a short distance after reaching the natural channel. Degraded water and land use downstream due to slugs of contaminants and sediment flushed out as a result of breaching of bypasses and impoundments may be completely eliminated through adequate hydraulic design and retaining portions of the stream valley with its natural channel.

Less grazing use due to lost point-watering sources (if the postmining water table is lowered through elimination of the original groundwater system) would be completely mitigated through replacement of as much water surface as had previously been in existence. This might be accomplished through the construction of stock ponds and wells tapping water below the spoil.

Possible water contamination through increased water use and wastes could be completely mitigated through proper sewage treatment facilities.

Characteristics of groundwater recharge, flow, and quality would be minimally changed on the Buckskin site. However, it is still anticipated that recharge and flow may be altered to some degree, and that water quality would be decreased, although data are not available to measure the degree of change.

### Revegetation (30 CFR 715.20)

The permittee shall establish on all land that has been disturbed, a diverse, effective, and permanent vegetative cover of species native to the area of disturbed land or species that will support the planned postmining uses of the land.

Revegetation shall be carried out in a manner that encourages a prompt regrowth of vegetative cover and recovery of productivity levels compatible with approved land uses. The vegetative cover shall be capable of stabi-

lizing the soil surface with respect to erosion. All disturbed lands, except water areas and surface areas of roads that are approved as a part of the postmining land use, shall be seeded or planted to achieve a vegetative cover of the same seasonal variety native to the area of disturbed land. Vegetative cover will be considered of the same seasonal variety when it consists of a mixture of species of equal or superior utility for the intended land use when compared with the utility of naturally occurring vegetation during each season of the year.

Where hayland, pasture, or range is to be the postmining land use, the species of grasses, legumes, browse, trees, or forbs for seeding or planting and their pattern of distribution shall be selected by the permittee to provide a diverse, effective, and permanent vegetative cover with the seasonal variety, succession, distribution, and regenerative capabilities of species native to the area. Livestock grazing will not be allowed on reclaimed land until the seedlings are established and can sustain managed grazing.

Where wildlife habitat is to be included in the postmining land use, the permittee shall consult with appropriate state and federal wildlife and land management agencies and shall select those species that will fulfill the needs of wildlife, including food, water, cover, and space. Plant groupings and water resources shall be spaced and distributed to fulfill the requirements of wildlife.

The ground cover of living plants on the revegetated area shall be equal to the ground cover of living plants in an approved reference area for a minimum of two growing seasons. The ground cover shall not be considered equal if it is less than 90% of the ground cover of the reference area for any significant portion of the mined area.

Species diversity, distribution, seasonal variety, and vigor shall be evaluated on the basis of the results which could reasonably be expected using methods of revegetation approved by the regulatory agency.

On the Buckskin site, analysis indicates that, over the long term, soil productivity would stabilize at 94% of premining levels, thereby reducing vegetative productivity proportionately.

## COMMITTED MEASURES

(A) The daily use of the access road by Buckskin mine employees would generate fugitive dust emissions along the length of the road outside of the mine property. In order to keep these emissions to a minimum the applicant has agreed to put a chip-and-seal surface on the access road. This would reduce the generation of fugitive dust from access road traffic by 85%. Thus, 0.77 pounds of dust per vehicle mile traveled would be expected, as opposed to 5.16 pounds per vehicle mile traveled if the access road were not chipped and sealed. Annual emissions from the access road would be reduced from 206 tons per year to 31 tons per year. Paving of the access road satisfies best management practice as required by the Environmental Protection Agency (EPA). EPA in-

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terprets best management practice as those procedures or techniques that can be reasonably (determined on a case-by-case economic basis) used to control fugitive dust.

(B) Piles of rocks and boulders placed on reclaimed areas will replace destroyed rock outcrops (microhabitats) which provide wildlife cover. These outcrops should be placed at a rate which will yield a level or density approximating premining occurrence.

Mining would eliminate rock outcrops and other types of cover which provide areas for concealment, dens, and/or nesting, and the reclaimed portion of the site would be lacking cover until shrub species are reestablished.

This measure would reestablish the microhabitats, and would also relieve some of the "smoothened" appearance of topography after reclamation. The feasibility of this measure is dependent upon the number of rocks and boulders available in the overburden material.

(C) Small reservoirs or depressions will be established during the reclamation of Spring Draw and Rawhide Creek for the collection of water, which will add to the value of the land for postmining land use. The Wyoming Department of Environmental Quality (DEQ) requested this measure in a letter to the permittee dated October 26, 1977.

The destruction of pools of standing water in Rawhide Creek due to mining activities would eliminate resting and nesting areas for waterfowl and shore birds and some essential life-sustaining areas for amphibians and some reptiles. It would also eliminate a primary source of drinking water for livestock, birds, and wildlife in the area of the mine.

If the retention of an equivalent amount of surface water can be maintained by artificially constructed pools, then the impact described would be almost totally reduced, with the exception that until aquatic and riparian vegetation becomes naturally established around these pools, the pools would not be as attractive to wildlife as they are presently.

(D) The mine operator will institute fire prevention and fire-fighting training programs as a part of the safety program. These training programs would have an indeterminate effect on reducing fire hazards and environmental and economic losses due to wildfire.

(E) Bureau of Land Management (BLM) fencing specifications which will allow deer and antelope migration will be used for fencing the mine and railroad spur. Woven-wire fences will be acceptable only where the animals must be excluded from a portion of the mine for their safety. DEQ requested this measure in a letter to the permittee dated October 26, 1977.

Use of three-wire fence with a maximum height of 38 inches and a smooth, barless wire 16 inches above the ground would alleviate about 75% of the antelope and deer loss from entanglement in fences, entrapment during winter storms, or prevention of movement to areas of available food and water. Such fencing would lose some of its mitigating effect during the winter if snow depth is above the bottom wire and animals are forced to jump fences.

(F) Based on discussions with the Wyoming State Engineer's Office (personal communication, Paul Thompson 1978), as a condition on the issuance of a water channel diversion permit, the diversions constructed at Buckskin would have to be designed to accommodate the runoff resulting from back-to-back (24-hour) 100-year storms.

This type of engineering design would alleviate much of the potential for breaching of the diversion channel when runoff reaches the flood stage. This measure would also minimize secondary impacts to soils, water quality, and downstream vegetation.

## Cultural Resources

Protective stipulations for both known and unknown archeological sites have been drawn up by the Wyoming State Archeologist and the Bureau of Land Management (BLM). These stipulations are subject to comment by the Advisory Council on Historic Preservation.

### Wyoming State Archeologist

(G) The proposed stipulations of the Wyoming State Archeologist for protection of known sites state, "No terrain altering activities should take place outside the proposed railroad corridor near 48 CA 89. This includes vehicular travel. If it is necessary to deviate from the present corridor, then additional archeological studies will be needed" If construction or vehicular traffic outside the railroad right-of-way is necessary, the Wyoming State Historic Preservation Officer and the District Manager, BLM, will be notified to complete studies and/or salvage of the tipi ring site.

The stipulations also state, "No construction or vehicular traffic should be allowed within 25 yards of 48 CA 130. Since 48 CA 130 is highly visible, care should be taken to prevent curiosity seekers, collectors, and other potential looters from digging in the site. Care should also be taken to assure that construction design does not cause new erosion to the shallow cultural deposits. If the site cannot be protected adequately, then additional studies, possibly complete salvage, will be necessary" The Wyoming State Historic Preservation Officer and the District Manager, BLM, will be notified if it is deemed necessary either to disturb the site during railroad spur construction and/or if vandalism by construction workers is likely. The permittee has added a disclaimer to the latter stipulation (letter from Shell, dated 1/14/78) saying that the company cannot be responsible for actions of people other than Shell personnel, since the land is privately owned and beyond their control.

These measures will be enforced by the regulatory authority and should be effective in protecting the known sites.

(H) As yet unknown archeological sites will be generally protected by the Wyoming State Archeologist. He proposes that a professional archeologist will observe and monitor topsoil removal on each side of Rawhide Creek, that the Wyoming State Historic Preservation Officer will be notified of any cultural resources unearthed

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during mining or construction, and that such resources will be protected until investigations can be made by a qualified archeologist.

This measure will be enforced by the regulatory authority. A qualified archeologist acceptable to the regulatory authority will be contracted by the permittee to be present during the initial surface disturbance of all of those areas of alluvial or wind-laid deposits identified in the inventory. Should a site or sites of National Register significance be encountered, appropriate mitigation will be conducted in consultation with the State Historic Preservation Office and Advisory Council. The archeologist will test sites uncovered to aid his or her professional judgement of the quality of such sites. The permittee may opt to conduct trenching and/or bore test holes on identified sensitive areas prior to mining or surface disturbances using an archeologist and acceptable methodology. Upon finding any type of cultural site, the operator will contact the regulatory authority.

The effectiveness of this measure depends on the amount of destruction a site would sustain as it is uncov-

ered, and the ability and willingness of workers to recognize and report subsurface sites.

### **Bureau of Land Management**

Stipulations proposed by the Bureau of Land Management are as follows:

(I) Periodic monitoring of known sites by BLM archeologist to check for weather-induced deterioration or vandalism.

(J) Stabilization of site 48 CA 130 and physical protection consisting of burial beneath sterile material. Stabilization and burial methods will be specified by BLM.

(K) Establishment of physical access controls (such as fencing and locked gates) along the railroad right-of-way to protect site 48 CA 89.

(L) Development of a subsurface testing program to ascertain if buried cultural resources exist along the portion of Rawhide Creek that crosses the lease.

TABLE BU4-1  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
AIR QUALITY					
Generation of fugitive dust emissions would cause an increase in total suspended particulates (TSP)	-	(A) paving of access road	-	will reduce 85% of dust on access road	fugitive dust emission from the entire project would be reduced by 14%-23%
Visibility would be reduced by increased TSP	-	(A) paving of access road	-	will reduce 85% of dust on access road	visibility impacts would be lessened by an unknown amount
Slight amounts of NO <sub>2</sub> , SO <sub>2</sub> , and HC would be generated by vehicles	-	-	-	-	impact unchanged
GEOLOGY					
Part of the geologic record would be lost	-	-	-	-	impact unchanged
Ground stability would be decreased	-	-	-	-	impact unchanged
Rock hunting would be increased	-	-	-	-	impact unchanged

BU4-6

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
<b>PALEONTOLOGY</b>					
Potential fossil bearing strata would be lost	-	-	-	-	impact unchanged
Unauthorized fossil collecting would increase	-	-	-	-	impact unchanged
<b>TOPOGRAPHY</b>					
Smooth depressions would result after mining	-	(B) placement of rock outcrops	-	outcrops will alleviate smoothness of terrain	depression would be smooth with some irregular outcrops
Landforms would be altered during mining	-	-	-	-	impact unchanged
Some railroad and road cuts may remain after mining	-	-	-	-	impact unchanged

BU4-7

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
<b>SOILS</b>					
Soil productivity would be reduced after reclamation	30 CFR 715.13 30 CFR 715.16	-	soils handling and postmining land use	soil productivity on this site can only be restored to 94% of original productivity	6% long term loss of soil productivity
Soil productivity would be lost for new urban areas	-	-	-	-	impact unchanged
Soil productivity would be lost while areas are being mined	-	-	-	-	impact unchanged
Topsoil would be lost to erosion	30 CFR 715.16 30 CFR 715.20	-	topsoil handling and revegetation	90-95% of topsoil can be retained on the site	5-10% loss of topsoil during mining
Topsoil could be contaminated by toxic materials	30 CFR 715.16	-	topsoil handling	operator shall redistribute topsoil to prevent excess contamination	some contamination could still occur

BU4-8

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
GROUNDWATER					
Water quality would be lowered in spoils after reclamation	30 CFR 715.17	-	overburden back- filling monitoring	SMCRA requires "minimization" of water qual- ity reduction	water quality in the spoils would probably be reduced to some extent
Water levels would be lowered in adjacent aquifers during mining	30 CFR 715.17	-	water supply, water monitoring	the operator will be required to replace water supplies lost to neighboring water users	water levels would still drop, but users would not be adversely affected
Valley floors designated as alluvial could be disturbed	30 CFR 715.17	-	various portions of entire M&R plan	in alluvial valley floors, operator must identify and study "essential hydrological functions" and either conduct operations to preserve these functions, or avoid mining such valley floors	in alluvial valley floors, "essential hydrologic functions" would be preserved

BU4-9

TABLE BU4-1  
 (cont'd)  
 EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
Water levels would be nearer the surface in spoils	30 CFR 715.14 30 CFR 715.17	-	overburden back-filling and grading monitoring	operator must monitor and conduct operations to minimize disturbance of hydrologic balance	water levels could still be nearer the surface
Infiltration and recharge would be altered in the spoil after reclamation	30 CFR 715.17	-	reclamation portion of plan, monitoring	reclamation will be conducted to restore "approximate" premining recharge capacity	infiltration and recharge could still be somewhat altered, but adverse effects are minimized
Coal and overburden aquifers would be destroyed by mining	-	-	-	-	impact unchanged
Consumptive use of groundwater could affect other users	30 CFR 715.17	-	water supply and monitoring	the operator will be required to replace water supplies lost to neighboring water users	other users will not be adversely affected

BU4-10

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
SURFACE WATER					
Surface water system would be destroyed by mining, water will be diverted around the mine	30 CFR 715.17	-	diversion channel	temporary diversion channels will be built to prevent changes in water quality and quantity	during mining, original system would be lost, but surface waters would be diverted in a manner to retain quantity and quality
After reclamation, surface water system would be altered from existing characteristics	30 CFR 715.13 30 CFR 715.14 30 CFR 715.17	(C) restoration of reservoirs	various portions of reclamation plan	changes in water quality, quantity and location shall be minimized to support postmining land use	surface water system characteristics could still be altered from existing ones, but adverse affects would be minimized
Shallow ponding could result after reclamation	30 CFR 715.13 30 CFR 715.14 30 CFR 715.17	-	overburden back-filling and grading, postmining land use	operator will conduct operations to minimize disturbance of hydrologic balance	shallow ponding could result in the long term due to settling of overburden

BU4-11

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
Peripheral gullying could result after reclamation	30 CFR 715.13 30 CFR 715.14 30 CFR 715.17	-	overburden back-filling and grading, postmining land use	slopes are to be equal or less than pre-mining slopes, this would eliminate 95% of gullying	some gullying (5%) would occur on slopes
During flooding, sedimentation would increase due to high stream velocities	-	-	-	-	impact unchanged
Breaching of bypass channel and impoundments would release low quality water downstream	30 CFR 715.17	(F) diversion channel design	diversion channels and impoundments	diversion channels and impoundment are to be built to prevent changes in water quality	maximum flooding could still result in some breaching
Leachate and surface runoff could enter to surface water system during mining	30 CFR 715.17	-	sedimentation control, water monitoring	best control technology will be applied to control pollution from runoff waters	reduction in water quality could occur, but adverse effects would be minimized

BU4-12

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
Increased surface water use by new population	-	-	-	-	impact unchanged
Water quality could be lowered by sewage effluents	-	-	-	-	impact unchanged
VEGETATION					
Vegetative productivity would be reduced after reclamation	30 CFR 715.13 30 CFR 715.16 30 CFR 715.20	-	topsoil handling revegetation, postmining land use	productivity levels can be restored on this site to 94% of pre-mining levels on this site	6% long term loss of vegetative productivity
Vegetative productivity would be lost for new urban areas	-	-	-	-	impact unchanged
Vegetative productivity would be lost while areas are being mined	-	-	-	-	impact unchanged
Species variety would be reduced	30 CFR 715.20	-	revegetation	operator must establish a vegetative cover of a seasonal variety native to the area	grasses would be more successful initially, resulting in lack of variety in the short term

BU4-13

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
Vegetative productivity could be reduced by increased dust during mining	-	(A) paving of access road	-	will reduce dust from access road by 85%	reduction in vegetative productivity would be mitigated by an unknown amount
Fire hazard would be increased during mining	-	(D) fire prevention and control training	-	unknown	would likely reduce hazard and loss from wildfire
Aquatic vegetation would be adversely affected	30 CFR 715.13 30 CFR 715.14 30 CFR 715.17	-	reclamation portion of plan	surface water system will be reclaimed to minimize impact on water quality, quantity and location	aquatic vegetation would be lost during mining, but reestablishment of surface water system may allow vegetation to reestablish itself
Vegetative productivity could be reduced by topsoil erosion	30 CFR 715.16 30 CFR 715.20	-	topsoil handling and revegetation	90-95% of soil can be retained on site	some reduction in vegetative productivity could result from loss of 5-10% of topsoil

BU4-14

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
WILDLIFE					
Wildlife habitat quality would be reduced after reclamation (affecting populations and carrying capacity)	30 CFR 715.13	(B) placement of rock outcrops (C) restoration of reservoirs	postmining land use	cover (rock outcrops) and watering will be somewhat restored, vegetative productivity can only be 94% restored on site	some habitat would be restored but 6% of vegetative productivity (carrying capacity) would be lost in the long term
Wildlife habitat would be lost during mining	-	-	-	-	impact unchanged
Carrying capacity would be lost during mining	-	-	-	-	impact unchanged
Wildlife populations would be lost	-	(E) use of BLM fence specifications	-	75% effective in reducing animal deaths along fences	wildlife populations would be lost by displacement during mining, with some re-population following mining, only 25% of game animal deaths on fences would occur

BU4-15

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
<b>CULTURAL RESOURCES</b>					
Known cultural sites could be damaged by mining activities	-	(G) (I) protection of known (J) sites (K)	-	damage to known sites will be prevented	no impact
Unknown sites could be uncovered and/or damaged by mining activities	-	(H) protection of unknown (L) sites	-	would avoid or reduce loss of subsurface sites	sites may be damaged in initial uncover- ing and may be lost if not immediately reported to archeologist
Cultural artifacts could be damaged or lost by increased, unauthorized collecting	-	-	-	-	impact unchanged
<b>VISUAL RESOURCES</b>					
Visual quality on the mines site would be reduced from Class IV to Class V	-	-	-	-	impact unchanged

BU4-16

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
Visual quality in new urban areas would be reduced from Classes II, III, or IV to Class V	-	-	-	-	impact unchanged
RECREATION					
Use of recreation facilities would be intensified	-	-	-	-	impact unchanged
"Primitive" recreation quality would be reduced	-	-	-	-	impact unchanged
Conflicts between landowners and recreationists would increase	-	-	-	-	impact unchanged
Numbers of huntable wildlife would be reduced	-	-	-	-	impact unchanged
Mining and urban increase would reduce the land use base	-	-	-	-	impact unchanged

BU4-17

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
Sightseeing of natural landscapes would be reduced	-	-	-	-	impact unchanged
AGRICULTURE					
AUMs (carrying capacity) would be reduced after reclamation	30 CFR 715.13	-	revegetation, post-mining land use	vegetative productivity can only be 94% restored on this site	long term loss of 6% of carrying capacity
AUMs would be lost while areas are being mined	-	-	-	-	impact unchanged
AUMs would be lost for new urban areas	-	-	-	-	impact unchanged
Forage productivity could be reduced by dust fallout	-	(A) paving of access road	-	will reduce dust from access road by 85%	reduction of forage productivity would be lessened by an unknown amount
Animal harrasment and unintention openings of enclosures would increase	-	-	-	-	impact unchanged

BU4-18

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
New rail and road access could split pastures and interrupt agricultural operations	-	-	-	-	impact unchanged
Surface water system alteration would affect agricultural operations	30 CFR 715.13 30 CFR 715.17	(C) restoration of reservoirs	reclamation portion of plan	surface water system will be reclaimed to minimize impact on water quality, quantity, and location	adverse impacts on agricultural operations would be minimized
Increased sediment release during floods would affect productivities	-	(F) diversion channel design	-	-	only maximum flooding would cause sedimenta- tion downstream
121 acres of cropland would be destroyed and not reestablished by reclamation	30 CFR 715.13	-	reclamation portion of plan	reclamation will restore lands to the uses they were capable of supporting prior to mining	unknown

BU4-19

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
MINERAL RESOURCES					
Coal would be converted to electrical energy	-	-	-	-	impact unchanged
Some coal would not be recovered by mining technology	-	-	-	-	impact unchanged
Sand, gravel, and scoria would be consumed in construction activities	-	-	-	-	impact unchanged
TRANSPORTATION					
Rail traffic would increase	-	-	-	-	impact unchanged
Street and highway traffic would increase	-	-	-	-	impact unchanged
Traffic and use of the Gillette airport would increase	-	-	-	-	impact unchanged

BU4-20

TABLE BU4-1  
(cont'd)  
EFFECTIVENESS OF MITIGATION AND RESIDUAL IMPACTS

Description of Impact of Proposed Action	SMCRA* Requirement (30 CFR 700)	Committed or Enforceable Mitigating Measure	Phase of Proposed Action Potentially Requiring Change or Addition (for SMCRA only)	Indication of Effectiveness & Feasibility	Residual** Impact
SOCIOECONOMICS					
City of Gillette would experience increased fiscal stress	-	-	-	-	impact unchanged
Housing requirements and needs would intensify	-	-	-	-	impact unchanged
Quality of life and character of Gillette and Campbell County would be changed	-	-	-	-	impact unchanged
Employment and wages would increase	-	-	-	-	impact unchanged

\* Surface Mining Control and Reclamation Act of 1977. Regulations cited were published in final form in December 1977.

\*\* "impact unchanged" entries in this column indicate no change from the impacts due to the proposed action.

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