APPENDIX C

RECLAMATION PLAN

TABLE OF CONTENTS

APPENDIX C

TABLE OF CONTENTS, Continued

LIST OF TABLES

LIST OF FIGURES

APPENDIX C

RECLAMATION PLAN

1.0 INTRODUCTION

The following erosion control, revegetation, mitigation measures, and management measures are designed to attain successful rehabilitation of disturbed areas associated with the DFPA Natural Gas Production project. These measures are designed to establish the feasibility of reclaiming disturbances associated with this project. The measures were developed based on 1) Bureau of Land Management (BLM) Wyoming State Office reclamation policy (USDI-BLM 1990b); 2) management directives presented in the Great Divide RMP (USDI-BLM 1988a,1990a) and Green River RMP (USDI-BLM 1996a, 1997); 3) impacts identified in the Environmental Consequences chapter (Chapter 4) of this environmental impact statement (EIS); 4) coordination with BLM staff; and 5) issues identified during the scoping process. The extent of possible disturbed areas to be reclaimed include the drill sites, access road, pipeline ROW's, and staging areas. The following measures apply to the Proposed Action and to Alternatives A and B unless identified for a specific alternative. The measures presented in this plan are designed to allow the project to be constructed without significant impacts to natural resources. Because of the large geographic area covered by the project and the lack of site-specific locations of project facilities, these measures are presented in a general, non-specific manner. Final selection of the measures to be applied at any given location, and modifications of these measures, will be identified by the BLM in coordination the Operators.

This reclamation plan outlines measures that will be taken to effectively reclaim areas disturbed during construction of the DFPA Natural Gas Production Project. These measures will be followed unless exceptions are granted or actions are modified by agreement between the BLM and the Operators. These measures describe how natural gas development activities should be managed to assure compliance with the resource management goals and objectives for the general area, applicable lease and unit area stipulations, and resource limitations identified during interdisciplinary (ID) team analyses. Initial monitoring for compliance and successful implementation of the mitigation measures will be under the direction of the Operators. Final approval and release will be under the direction of the BLM.

Reclamation measures covered in this plan fall into two general categories: temporary and final reclamation. Temporary reclamation refers to measures applied to stabilize disturbed areas and to control runoff and erosion during time periods when application of final reclamation measures is not feasible or practicable. Final reclamation refers to measures that should be applied concurrently with completion of drilling and pipeline installation.

Reclamation potential may be limited by salinity, alkalinity, steep slopes, shallow soils, depth to bedrock, low precipitation, stoniness, high wind and water erosion, periodic flooding, short growing season, seasonably high water tables, and strong winds. Special intensive land-use practices may be necessary to mitigate salt and sediment loading caused by surface-disturbing activities within the project area. Activity plans (e.g., applications for permit to drill [APD's]) should address site-specific problems, including monitoring for salt and sediment loading (USDI-BLM 1990b).

In general, temporary reclamation measures should be applied to all areas not promptly reclaimed to final conditions within a specified time period whether due to adverse weather conditions, inability to secure needed materials, and/or seasonal constraints, etc. Temporary reclamation measures should be applied only as needed; as in most cases, final reclamation

measures should be applied concurrently as sections of the project are completed. Temporary reclamation measures may be applied more rigorously to sensitive areas such as drainage channel crossings, steep slopes, and areas prone to high wind and water erosion. Temporary reclamation measures should include regrading the disturbed area to near pre-disturbance contour, re-spreading salvaged topsoil, mulching, and placing runoff and erosion control structures.

Final reclamation measures, in general, involve regrading the disturbed area to near pre-disturbance contour, re-spreading salvaged topsoil, applying soil amendments (if necessary), applying a prescribed seed mixture, mulching, and placing runoff and erosion control structures such as water bars and silt fences. The duration of the resultant impacts to the various vegetation community types depends in part on the success of implementation of the reclamation measures prescribed in this appendix and the time required for natural succession to return disturbed areas to pre-disturbance conditions after project completion.

Because wetlands are "waters of the U.S." and are therefore protected under the federal Clean Water Act (CWA), discharge of dredge or fill material into, and/or excavation of wetlands could require administrative coordination with the U.S. Army Corps of Engineers (COE) pursuant to the CWA and may require a Section 404 permit. The COE, based on the exact nature of the disturbance activity should determine the type of permit (Individual, Regional, or Nationwide) required according to the rules and regulations presented in the Federal Register (1986). Avoidance of waters of the U.S. and wetlands should be the highest priority. A suitable wetland mitigation plan should be developed for the areas of wetlands directly impacted due to project activities where avoidance is not practicable. Impact minimization should include reducing the area of disturbance in wetland areas as well as utilizing procedures specified by authorizing agencies to cross intermittent and ephemeral drainage channels and wetland areas.

Although intermittent and ephemeral drainage channels are not considered wetlands, the same requirements apply to the discharge of dredge and fill into them as for discharge into wetlands. Residual wetland impacts that could occur after maximum avoidance and/or impact minimization has been demonstrated should be mitigated according to the following order of priority: 1) avoidance; 2) impact minimization; 3) mitigation in-kind, on-site; 4) mitigation in-kind, off-site; 5) mitigation out-of-kind, on-site; and 6) mitigation out-of-kind, off-site. In addition, the following modes of mitigation could be implemented for wetland mitigation if avoidance and impact minimization were not feasible: 1) wetlands restoration; 2) wetlands creation; and 3) wetlands enhancement. The wetlands mitigation plan should be designed to replace the area of impact and functional values associated with the disturbed area.

Appropriate BLM and Natural Resources Conservation Service (NRCS) range conservationists were contacted to determine agency-specific seeding recommendations at drill sites and along access road and pipeline ROW's. The recommended seed mixtures in this plan were developed with input from these land management agencies. The reclamation measures in this report assume that baseline data would be collected in various areas along the access road and pipeline ROW's and at drill sites prior to construction activities by an authorized reclamation scientist.

2.0 OBJECTIVES

This plan is designed to meet the following objectives for reclamation of the access road/pipeline ROW's and the drill sites:

Short-Term (Temporary) Reclamation:

- Immediately stabilize the disturbed areas by mulching (if needed), providing runoff and erosion control, and through the establishment of new vegetation (required for problem areas; may be optional for other areas depending on consultation with the BLM).
- Control and minimize surface runoff, erosion, and sedimentation through the use of diversion and water treatment structures.

Long-Term (Final) Reclamation:

- Immediately stabilize the disturbed soil surface by mulching (if needed and as directed by the BLM), runoff and erosion control, and through the establishment of new vegetation. Adequate surface roughness should exist to reduce runoff and to capture rainfall and snow melt.
- Control and minimize surface runoff, erosion, and sedimentation through the use of diversion and water treatment structures.
- Restore primary productivity of the site and establish vegetation that will provide for natural plant and community succession.
- Establish a vigorous stand of desirable plant species that will limit or preclude invasion of undesirable species, including invasive, non-native species.
- Revegetate the disturbed areas with native plant species useful to wildlife and livestock.
- Enhance aesthetic values. In the long-term, reclaimed landscapes should have characteristics that approximate the visual quality of adjacent areas, including location, scale, shape, color, and orientation of major landscape undisturbed features.

3.0 PERFORMANCE STANDARDS

The following performance standards should be used to determine the attainment of successful revegetation:

All Years:

- Protective cover. With the exception of active work areas, all disturbed highly erosive or sensitive areas to be left bare, unprotected, or unreclaimed for more than one month will have at least a 50 percent cover of protective material in the form of mulch, matting, or vegetative growth. All disturbed areas should have at least a 50 percent cover of protective material within six months after reclamation.

Second Year (Final Reclamation):

- Seedling density. The density and abundance of desirable species is at least three to four seedlings per linear foot of drill row (if drilled) or transect (if broadcast). Vegetative

transects will be established on a permanent basis so that transects can be measured annually through the five year monitoring period.

- Percent cover. Total vegetal cover will be at least 50 percent of predisturbance vegetal cover as measured along the reference transect for establishing baseline conditions.

By the Fifth Year (Final Reclamation):

- Percent cover. Total vegetal cover will be at least 80 percent of predisturbance vegetal cover as measured along the reference transect for establishing baseline conditions.

- Dominant species. Ninety percent of the revegetation consists of species included in the seed mix and/or occurs in the surrounding natural vegetation, or as deemed desirable by the BLM as measured along the reference transect for establishing baseline conditions.

- Erosion condition/soil surface factor. Erosion condition of the reclaimed areas is equal to or in better condition than that measured for the reference transect for establishing baseline conditions.

4.0 METHODS

4.1 Drill Site, Access Road, and Pipeline Right-of-Way Clearing and Topsoil Removal and Storage

Topsoil should be handled separately from subsoil materials. At all construction sites, topsoil should be stripped to provide for sufficient quantities to be respread to a depth of at least four to six inches over the disturbed areas to be reclaimed. In areas where deep soils exist (such as floodplains and drainage channel terraces), at least 12 inches of topsoil should be salvaged. Where soils are shallow or where subsoil is stony, as much topsoil should be salvaged as possible. Topsoil should be stockpiled separately from subsoil materials. Topsoil salvaged from drill sites and stored for more than one year should be bladed to a specified location at these areas, seeded with a prescribed seed mixture, and covered with mulch for protection from wind and water erosion and to discourage the invasion of weeds. Topsoil stockpiles should not exceed a depth of 2-feet. Topsoil should be stockpiled separately from other earth materials to preclude contamination or mixing and should be marked with signs and identified on Construction and Design plans. Runoff should be diverted around topsoil stockpiles to minimize erosion of topsoil materials. In most cases, disturbances will be reclaimed within one year. Therefore, it is unlikely that topsoil stockpiling for more than one year will be required. Salvaged topsoil from roads and drill sites will be respread over cut-and-fill surfaces not actively used during the production phase. Upon final reclamation at the end of the project life, topsoil spread on these surfaces will be used for the overall reclamation effort.

Operators are finding out that it is not always necessary to remove all vegetation and strip all topsoil within a pipeline ROW. In many areas, such as with deep soils on relatively flat smooth slopes with low gradients, it is possible to crush in-place rather than clear vegetation and leave topsoil in-place rather than blade and stockpile. This technique would reduce the magnitude and severity of disturbance impacts and hasten successful reclamation.

In federal jurisdictional wetland areas, vegetation should be cut off only to the ground level, leaving existing root systems intact. Cut vegetation should be removed from wetland areas for

disposal. Grading activities should be limited to directly over pipeline trenches and access roads. At least 12 inches of topsoil should be salvaged and replaced except in areas with standing water or saturated soils. Use of construction equipment in wetland areas should be limited. Dirt, rockfill, or brush riprap should not be used to stabilize pipeline ROW's. If standing water or saturated soils are present, wide-track or balloon-tire construction equipment should be used or normal construction equipment should be operated on equipment pads or geotextile fabric overlain with gravel fill. Equipment pads etc., should be removed immediately upon completion of construction activities. Trench spoil should be placed at least 10 feet away from drainage channel banks for all minor and major drainage channel crossings.

4.2 Drill Site, Access Road, and Pipeline Right-of-Way Construction

4.2.1 Upland Areas

Uplands include all areas away from wetlands and alluvial bottomlands or other areas that have excess soil moisture for prolonged periods or have shallow water tables. Construction should be accomplished following site-specific Construction and Design plans and applicable agency specifications. At drill sites, and along the areas of access road or pipeline ROW traversing steep slopes, slope angles should be minimized to enhance retention of topsoil, and reduce erosion as well as facilitate revegetation, and subsequent reclamation success. Slope stabilizing revetment structures may be necessary in areas where the substrata materials are unconsolidated and loose and cannot be stabilized with revegetation and mulch.

Surface runoff should be controlled at all well sites through the use of interception ditches and berms. A berm approximately 18 inches high should be constructed around fill portions of these well sites to control and contain all surface runoff generated or fuel or petroleum product spills on the pad surface. Water contained on the drill pads should be treated in a detention pond prior to discharge into undisturbed areas in the same manner as discussed previously. This system should also serve to capture fuel and chemical spills, should they occur.

Erosion and sedimentation control measures and structures should be installed on all disturbed areas. Soil erosion control should be accomplished on sites in highly erosive soils and steep areas with mulching, netting, tackifiers, hydromulch, matting, and excelsior. The type of control measure should depend on slope gradients and the susceptibility of soil to wind and water erosion. Silt fences should be placed at the base of all steep fill slopes and sensitive disturbed areas. All runoff and erosion control structures should be inspected periodically, cleaned out, and maintained in functional condition throughout the duration of construction and drilling. Water bars should be constructed on cut-and-fill slopes exceeding 25 feet long and 10 percent gradient using the water bar spacing guidelines and procedures specified for access road and pipeline ROW runoff and erosion control (BLM Manual 9113).

Runoff and erosion control along access road/pipeline ROW'S should be accomplished by implementing standard cross drain, culvert, road ditch, and turnout design as well as timely mulching and revegetation of exposed cut, fill, and road shoulders. All culverts should be constructed with riprapped entrances and exits and with energy dissipaters or other scour-reducing techniques where appropriate. Water discharged from culverts, cross drains, road ditches and turnouts should be directed into undisturbed vegetation away from all natural drainages. Erosion and sedimentation control measures and structures should be installed across all cut-and-fill slopes within 100 feet of drainage channels. All runoff and erosion control structures should be inspected after major runoff events and at a regular schedule. If found to be sub-standard, these structures should be cleaned out and maintained in functional condition throughout the life of the project.

4.2.2 Drainage Channel Crossings

Construction of drainage channel crossings should minimize the disturbance to drainage channels and wetlands to the extent practicable and should occur during the low runoff period (June 15 through March 1). Staging areas should be limited in size to the minimum necessary and should be located at least 50 feet from drainage channel bottoms, where topographic conditions permit. Hazardous materials should not be stored and equipment should not be refueled within 100 feet of drainage channels. Drainage channel crossings should be constructed as perpendicular to the axis of the drainage channel and at the narrowest positions as engineering and routing conditions permit. Clean gravel should be used for the upper one foot of fill over the backfilled pipeline trenches within drainage channel crossings.

4.2.3 Wetlands

Access roads and pipelines should be rerouted, and drill sites located, to avoid wetland areas to the maximum extent practicable. The size of staging areas should be limited to the minimum necessary and all staging areas should be located at least 50 feet from the edge of federally delineated wetland areas, where topographic conditions permit. The width of the access road and pipeline construction ROW should be limited to no more than 50 feet. Hazardous materials should not be stored and equipment should not be refueled within 100 feet of wetland boundaries.

Appropriate permits should be secured from the COE prior to any construction activities in federal jurisdictional wetland areas.

4.3 Surface Runoff and Erosion Control

4.3.1 Drill Site, Access Road, and Pipeline Right-of-Way

4.3.1.1 Temporary Reclamation

Temporary erosion control measures may include application of mulch and netting of biodegradable erosion control blankets stapled firmly to the soil surface, respreading scalped vegetation, or construction of water bars. See Final Reclamation measures (Section 4.4) for specific information pertaining to mulching.

The actual distance of a pipeline/road ROW requiring stabilization on each side of a drainage channel should be determined on a site-specific basis. To minimize sedimentation of drainage channels and wetlands during the interim period between construction activity and final reclamation, temporary erosion and sediment control measures should be applied. Silt fences or other sediment filtering devices such as weed-free straw bales should be installed along drainage channel banks where sedimentation is excessive and at the base of all slopes adjacent to wetlands. Figure C-1 presents schematics of water bar and silt fence construction. Sediment filtering devices should be cleaned out and maintained in functional condition throughout the life of the project. To avoid the possibility of mulching materials entering waterways, loose mulch (i.e., mulch not crimped into the soil surface, tackified, or incorporated into erosion control blankets) should not be applied to drainage channel banks.

If construction is completed more than 30 days prior to the specified seeding season for perennial vegetation, areas adjacent to the larger drainage channels should be covered with jute matting for a minimum of 50 feet on either side of the drainage channel. In addition, to

protect soil from raindrop impact and subsequent erosion, 2.0 tons/acre of a weed-free straw mulch should be applied to all slopes greater than 10 percent. Temporary erosion control measures may include leaving the ROW in a roughened condition, respreading scalped vegetation, or applying mulch. As indicated by several operators and the BLM, weed-free straw mulch is difficult to obtain in quantities and at costs suitable for all reclamation applications. Although this circumstance could reduce the application of the measure, the effectiveness of mulch in protecting the exposed soil from raindrop impact, erosion, and off-site sedimentation should not be ignored. In addition to its effectiveness in erosion control, mulching also benefits the soil as a plant growth medium in many cases. Therefore, effective mulching is fundamental to reducing soil erosion to acceptable, non-significant levels.

Trench breakers should be used for pipeline construction in certain areas to prevent the flow of water in either a trench that has been backfilled or temporarily left open. Trench breakers are particularly important in wetland areas to minimize subsurface drainage. Trench breakers should be constructed such that the bottom of one breaker is at the same elevation as the top of the next breaker down slope, or every 50 feet, whichever is greater. Factors that control the application of trench breakers include the proximity to drainage channels and wetland areas, slope gradient, proximity of areas to shallow groundwater, and surface runoff source areas that can discharge water into the trench. Trench breakers should be installed, where necessary. Topsoil should not be used to construct trench breakers.

If a pipeline crosses roads at the base of slopes, vegetative strips should be maintained. If vegetation is disturbed within these limits, temporary sediment barriers such as silt fences and/or staked weed-free straw bales should be installed at the base of the slope adjacent to the road crossing. Temporary sediment barriers should remain in-place until permanent revegetation measures have been judged successful.

4.3.1.2 Final Reclamation

4.3.1.2.1 Upland Areas

Runoff and erosion control along all ROW'S should be accomplished by constructing sediment trapping devices (e.g., silt fences and straw bales) and water bars, as well as by timely mulching and revegetation of exposed disturbed areas. Runoff discharged from water bars should be directed into undisturbed vegetation away from all natural drainages. Erosion and sedimentation control measures and structures should be installed across all cut-and-fill slopes. All runoff and erosion control structures should be inspected after major runoff events and on a regular schedule.

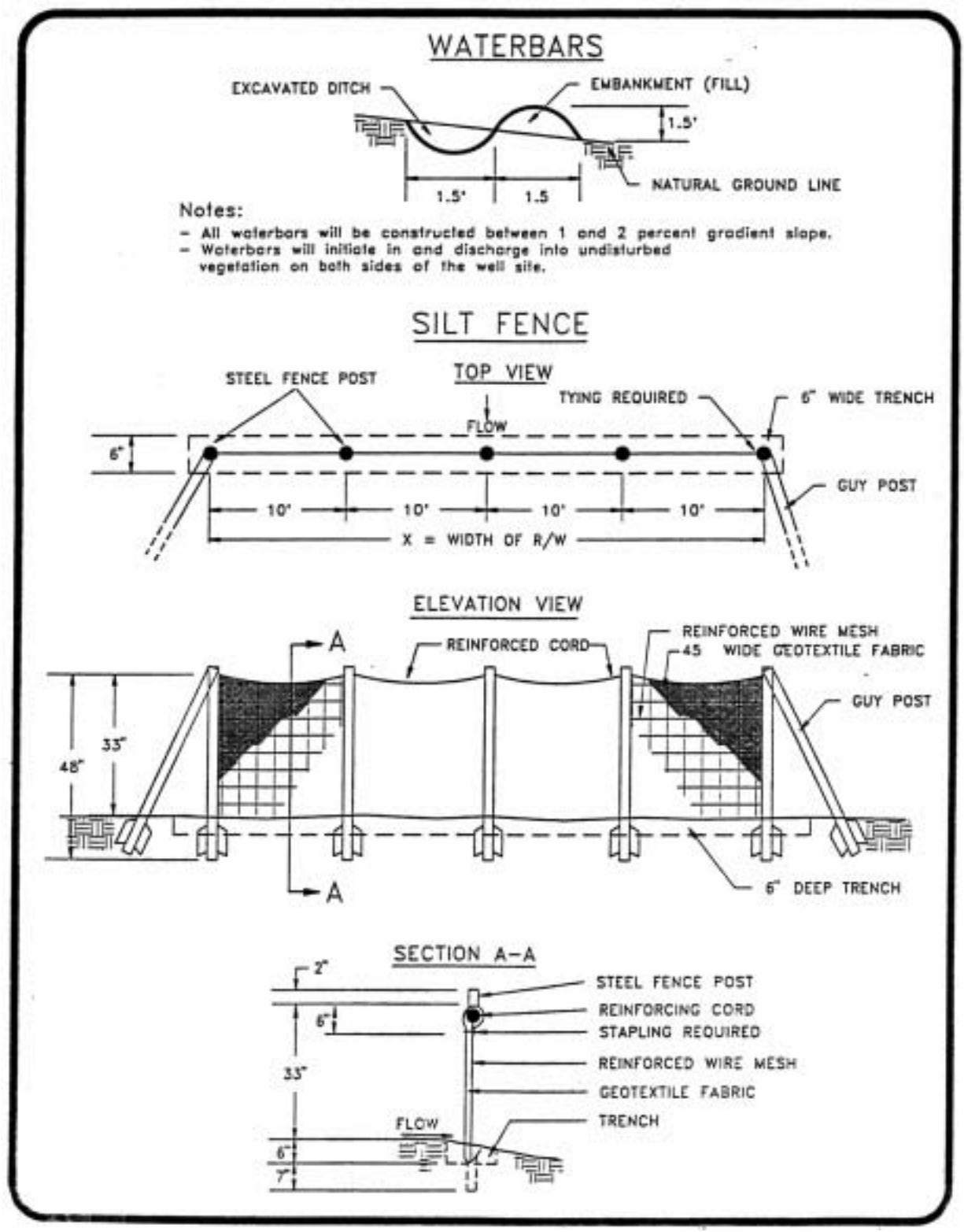

Figure C-1. Water Bar Construction and Silt Fence Construction.

If found to be substandard or ineffective, these structures should be cleaned out and maintained in functional condition until successful revegetation and soil stability is attained.

Water bars should be constructed across sideslopes at appropriate intervals according to slope gradient immediately following recontouring of the disturbed areas. The spacing should depend on whether mulching is applied in conjunction with placement of water bars. Water bars should be maintained in functional condition throughout the life of the project. Should the integrity of the water bar system be disrupted during seeding, water bars should be repaired and broadcast seeded with the seed raked into the soil. Water bars should be constructed according to hillslope topography at the slope gradient intervals as shown in Table C-1.

Water bars should be constructed 12 to 18 inches deep by digging a small trench and casting the soil material to the downhill side in a row. Each water bar should initiate in undisturbed vegetation upslope, traverse the disturbed area perpendicular to the ROW at a gradient between one and two percent, and discharge water into undisturbed vegetation on the lower side of the disturbed area.

Table C-1. Water Bar Intervals According to Slope Gradient[1].

With Mulching		Without Mulching	
Slope Gradient (percent)	**Interval (feet)**	**Slope Gradient (percent)**	**Interval (feet)**
10	150	10	100
15	100	15	75
20	50	20	45
30	40	30	40
40	35	40	35
50	30	50	30
>50	30	>50	30

[1] Based on Grah (1989)

4.3.1.2.2 Wetlands and Drainage Channel Crossings

Disturbance to the ephemeral and intermittent drainage channels should be avoided and/or minimized. All channel crossings not maintained for access roads should be restored to near predisturbance conditions. Drainage channel bank slope gradients should be regraded to conform with adjacent slope gradients. Channel crossings should be designed to minimize changes in channel geometry and subsequent changes in flow hydraulics. Culverts should be installed for ephemeral and intermittent drainage channel crossings. All drainage channel crossing structures should be designed to carry the 25- to 50-year discharge event as directed by the BLM. Silt fences should be constructed at the base of slopes at all drainage channel crossings. Minor routing variations should be implemented during access road, pipeline, and drill site layout to avoid washes. The area of disturbance in the vicinity of washes should be minimized. Per the Great Divide Resource Area Resource Management Plan (RMP), a 500-foot-wide buffer strip of natural vegetation should be maintained between all construction activities and drainage channels.

Trench plugs should be employed at non-flumed drainage crossings to prevent diversion of drainage channel flows into upland portions of pipeline trenches during construction. Application

of riprap should be limited to areas where flow conditions prevent vegetative stabilization; riprap activities must comply with COE permit requirements. Pipeline trenches should be dewatered in such a manner that no silt laden water flows into active drainage channels (i.e., prior to discharge the water should be filtered through a silt fence, weed-free straw bales, or allowed to settle in a sediment detention pond).

4.4 Final Reclamation

4.4.1 Topsoil Respreading and Seedbed Preparation

In preparation for seeding, topsoil that was initially removed should be evenly spread over the pipeline ROW, staging areas, cut-and-fill surfaces, and all areas of other sites not required for production purposes.

Soil compaction could result from heavy equipment working on disturbed soils prior to revegetation. Therefore, compaction is likely to occur under most situations. Soil compaction can inhibit adequate revegetation of disturbance areas. Therefore, all disturbances to be revegetated will be ripped to reduce the adverse effect of compaction. All disturbed areas should be ripped on 18- to 26-inch spacing and 12 to 16 inches deep. A spring tooth harrow equipped with utility or seedbed teeth, or ripper-teeth equipment mounted behind a large crawler tractor or patrol should be used to loosen the subsoil. The subsoil surface should be left rough. After topsoil has been respread and if it is loose, it should be compacted with a cultipacker or similar implement to provide a firm seedbed. On steep slopes (greater than 40 percent and highly erosive), it may be difficult or impossible to replace topsoil and adequately prepare the seedbed. The disturbed areas on steep slopes should be ripped as described above. These areas should then be mulched with a hydromulch/seed/tackifier mix. Erosion control blankets with seed incorporated into the matting should be installed per manufacturer's specifications to enhance soil stabilization.

4.4.2 Seed Application

Upon completion of final grading, soil surfaces should either be seeded, or erosion control measures should be used until the site is seeded. Late fall is typically a good time of year to seed, however timing of seeding should be adjusted depending upon weather, soil moisture conditions and the plant species being used. The seedbed should be prepared to a depth of three to four inches where possible to provide a firm seedbed. If hydroseeding or broadcast seeding is employed, the seedbed should be scarified to ensure good seed-soil contact. After completion of seedbed preparation, the seed mixtures presented in Tables C-2 through C-5, or a similar mix should be applied according to the pure live seed (PLS) rates and drilling depths specified, to areas along the road and pipeline ROW, staging areas, and unused areas of drill sites that have been retopsoiled.

Seed should be used within 12 months of viability testing. Legume species purchased commercially must have been properly inoculated with nitrogen-fixing bacteria. Seed should be planted in the fall (after September 31) or no later than late fall (mid-November) prior to snow accumulation to avoid seed germination and breaking of dormancy and to prevent seedling frost damage; or in early Spring (prior to May 15). Seed should preferably be planted with drill-type equipment such as a rangeland drill or brillion seeder. Where the microtopography of the disturbed areas does not allow drill-type equipment, seed should be broadcast applied at twice the application rate of drilled seed. A spike-toothed harrow or similar equipment should be used where ripping has been insufficient to provide cover for the broadcast seed.

Any soil disturbance that occurs outside the recommended permanent seeding season, or any bare soil left unstabilized by revegetation, should be treated as a winter-construction problem and mulching should be considered, or the site stabilized.

The seed mixtures presented in Tables C-2 through C-5, or similar mixtures should be applied according to specific areas identified to be homogeneous in terms of overall ecosystem similarities such as precipitation zones, elevational zones, dominant species herbaceous cover, soil types, and inherent limitations in reclamation success potential. Specifically, Seed Mixture #1 (Table C-2) should be applied to disturbances in the sagebrush-dominated mixed desert shrub and juniper woodland community types. Seed Mixture #2 (Table C-3) should be applied to disturbances in the more moist alkaline mixed desert shrub community types. Seed Mixture #3 (Table C-4) should be applied to greasewood-dominated mixed desert shrub communities in alkaline valley bottoms and bluffs. Seed Mixture #4 (Table C-5) should be applied to disturbances in wet meadow community types. These seed mixes were developed based on the following criteria: 1) site-specific conditions of the analysis area; 2) usefulness of species in rapid site stabilization; 3) species success in revegetation efforts; and 4) current seed costs and availability. Native plant species should be used, and final seed mixes applied in the revegetation effort should be designed in coordination with the BLM.

Final determination of the appropriate seed mixture should be developed on a site-specific basis at the time of field review of the facility. Seeding rates may be varied to enhance the probability for maintaining the natural balance of species. Watershed protection must be emphasized when reclaiming disturbed areas. The composition of rare and native species, if encountered, should be taken into consideration at the time of seeding; however, appropriate measures must be taken to ensure that an adequate protection of the soil surface is maintained. Areas not exhibiting successful revegetation throughout the entire area disturbed by the project should be re-seeded until an adequate cover of vegetation is established. Private and agricultural lands should be seeded with similar seed mixes unless the landowner requests different mixes.

4.4.3 Mulching

In sensitive sites where significant erosion (e.g., large areas of disturbance or areas with high erosion rates) is most likely to occur, the seeded access road/pipeline ROW, staging areas, and the portion of the drill pads not needed for production purposes should be mulched following seeding to protect the soil from wind and water erosion, raindrop impact, surface runoff, and invasive, non-native species invasion, and to hold the seed in place. The exposed surface of disturbed areas, including topsoil stockpiles, may be protected by placing crimped straw mulch, hydromulch, biodegradable plastic netting and matting, or biodegradable erosion control blankets.

All sensitive disturbed areas should be mulched immediately following seeding with 1.5 to 2.0 tons/acre of a weed-free straw mulch. Mulching materials should be free of invasive, non-native species and undesirable plant species as defined by state or county lists. Hay mulch may be used, but it should be applied only if cost-competitive and if crimped into the soil. Straw mulch is more desirable than hay mulch because it is generally less palatable to wild horses, wildlife, and livestock. Additionally, there tends to be a higher risk of introducing undesirable species and invasive, non-native species with a hay mulch such as smooth brome, timothy, orchardgrass and other minor species. The lessee should maintain all disturbances relatively weed-free for the life of the project through implementation of an invasive, non-native species monitoring and eradication program.

Table C-2. Seed Mixture[1] #1 - Mixed Desert Shrub, Badlands, and Juniper Woodland Community Types.

Species	Cultivar or Variety	Seed Application Drilled Rate (pls[2] lbs/ac)	Planting Depth (if drilled) (inches)
Grasses			
Western wheatgrass (*Agropyron smithii*)	Rosanna	2.0	0.5
Bluebunch wheatgrass (*Agropyron spicatum*)	Secar	2.0	0.5
Bottlebrush squirreltail (*Sitanion hystrix*)	-	2.0	0.5
Indian ricegrass (*Oryzopsis hymenoides*)	Nezpar	2.0	0.5
Needle-and-Thread (*Stipa comata*)	-	2.0	0.5
Forbs			
Gooseberryleaf globemallow (*Sphaeralcea grossulariaefolia*)	-	1.0	0.5
Cicer milkvetch (*Astragalus cicer*)	Monarch	1.0	0.5
Shrubs			
Wyoming big sagebrush (*Artemisia tridentata*)	-	0.5	0.25
Antelope bitterbrush (*Purshia tridentata*)	-	1.0	0.5
Fourwing saltbush (*Atriplex canescens*)	-	1.0	0.5
TOTAL		**14.5**	

[1] Seed mix based on adaptation to the site conditions of the project, usefulness of species for rapid site stabilization, species success in revegetation efforts, and current seed availability and cost.

[2] PLS = pure live seed.

Table C-3. Seed Mixture[1] #2 - Moist Alkaline Areas in the Mixed Desert Shrub Community Type.

Species	Cultivar or Variety	Seed Application Drilled Rate (pls[2] lbs/ac)	Planting Depth (if drilled) (inches)
Grasses			
Spike Muhly (*Muhlenbergia wrightii*)	El Vado	2.0	0.5
Alkaligrass (*Pucinellia distans*)	Fults	5.0	0.5
Alkali sacaton (*Sporobolus airoides*)	Salado	3.0	0.5
Forbs			
Strawberry clover (*Trifolium fragiferum*)	O'Connors, Salina	2.0	0.5
Shrubs			
Fourwing saltbush (*Atriplex canescens*)	-	1.0	0.5
Shadscale (*Atriplex confertifolia*)	-	1.0	0.5
TOTAL		**14.0**	

[1] Seed mix based on adaptation to the site conditions of the project, usefulness of species for rapid site stabilization, species success in revegetation efforts, and current seed availability and cost.

[2] PLS = pure live seed.

Table C-4. Seed Mixture[1] #3 - Greasewood-Dominated Valley Bottoms and Bluffs.

Species	Cultivar or Variety	Seed Application Drilled Rate (pls[2] lbs/ac)	Planting Depth (if drilled) (inches)
Grasses			
Western wheatgrass (*Agropyron smithii*)	Rosanna	3.0	0.5
Pubescent wheatgrass (*Agropyron tricophorum*)	Luna	2.0	0.5
Alkali sacaton (*Sporobolus airoides*)	-	2.0	0.25
Russian wildrye (*Elymus junceus*)	Vinall	2.0	0.25
Forbs			
Cicer milkvetch (*Astragalus cicer*)	Monarch	3.0	0.5
Shrubs			
Fourwing saltbush (*Atriplex canescens*)	-	1.0	0.5
Gardner saltbush (*Atriplex gardneri*)	-	1.0	0.5
Winterfat (*Ceratoides lanata*)	-	1.0	0.5
TOTAL		**15.0**	

[1] Seed mix based on adaptation to the site conditions of the project, usefulness of species for rapid site stabilization, species success in revegetation efforts, and current seed availability and cost.

[2] PLS = pure live seed.

Table C-5. Seed Mixture[1] #4 - Wet Meadow Community Types.

Species	Cultivar or Variety	Seed Application Drilled Rate (pls[2] lbs/ac)	Planting Depth (if drilled) (inches)
Grasses			
Spike muhly (*Muhlenbergia wrightii*)	El Vado	2.0	0.5
Redtop (*Agrostis stolonifera*)	-	1.0	0.5
Tufted hairgrass (*Deschampsia cespitosa*)	-	4.0	0.25
Forbs			
Red clover (*Trifolium pratense*)	Kenland	2.0	0.5
Strawberry clover (*Trifolium fragiferum*)	O'Connors, Salina	2.0	0.5
TOTAL		**13.0**	

[1] Seed mix based on adaptation to the site conditions of the project, usefulness of species for rapid site stabilization, species success in revegetation efforts, and current seed availability and cost.

[2] PLS = pure live seed.

Wherever utilized, mulch should be spread uniformly so that at least 75 percent of the soil surface is covered. If a mulch blower is used, the straw strands should not be shredded less than eight inches in length to allow effective anchoring. On slopes less than 30 percent, straw mulch should be applied by a mechanical mulch blower at a rate of 2.0 tons/acre after seeding. The mulch should be crimped into the soil surface using a serrated disc crimper. Where broadcast straw mulch is applied on windswept slopes, a biodegradable plastic netting should be staked firmly to the soil surface over the mulch following the manufacturer's specifications. On slopes in excess of 40 percent or on slopes exceeding the operating capabilities of machinery, hydromulch or biodegradable erosion control blankets with seed incorporated into the netting should be applied and staked firmly to the soil surface.

Where utilized, hydromulch and tackifier should be applied at a rate of 1,500 lbs/acre. In general, erosion control and soil stabilization are directly related to the amount of mulch applied. Under certain conditions where degradation processes are slow (e.g., in extremely hot or cold dry climates), a trade-off between the degree of effectiveness of mulch and long-term degradation should be considered. In extremely dry areas where mulch degradation may be slow, mulching rates should be reduced to 1.0 to 1.5 tons/acre. Special measures may need to be implemented in areas with sandy soils.

On steeper slopes with highly erodible, shallow, rocky soils and/or on windswept areas with loose, unconsolidated materials, the above recommended measures may not be sufficient to

reduce erosion to non-significant levels. The following measure should be considered by the operator and the BLM to stabilize such sites: incorporating a custom blend of seed into erosion control blankets. This method has proven cost-effective in many cases, with 98 percent of the cost being the blanket itself. The additional cost of incorporating seed into the blanket will average $1.00 to $1.50 per blanket, depending upon current seed costs. In most cases, this additional cost should offset the repeated efforts of broadcast seeding, manual raking of seeds into the soil, and mobilizing a labor force. The final measure(s) to be implemented in such areas should be determined by agreement between the BLM and Operators.

4.4.4 Livestock Control

Livestock grazing should be monitored on and along all drill sites, access road, and pipeline ROW's. Should grazing negatively impact revegetation success, measures should be taken to immediately remove livestock from the newly reclaimed areas. Depending upon site-specific evaluations, it may be necessary to temporarily fence off certain riparian areas and wetlands to prevent excessive livestock grazing and trampling to enhance drainage channel bank stabilization and overall revegetation success. Existing livestock control structures such as fences and cattle guards should be maintained in functional condition during all phases of the project. Where access requires the disruption of an existing fence, a cattle guard should be installed at the junction.

4.4.5 Off-Road Vehicle Control

Off-road vehicle control measures should be installed and maintained following the completion of seeding. Examples of practicable measures include a locking, heavy steel gate with fencing extending a reasonable distance to prevent bypassing the gate, with appropriate signs posted; a slash and timber barrier; a pipe barrier; a line of boulders; or signs posted at all points of access at intervals not to exceed 2,000 feet indicating "This Area Seeded for Wildlife Benefits and Erosion Control."

4.4.6 Fugitive Dust Control

Should fugitive dust generated during construction of the drill sites, access road/pipeline ROW'S, or staging areas become a problem, dust abatement measures should be implemented. Such procedures could include applying water or water with additives (e.g., magnesium chloride) to the construction area at regular intervals.

4.5 Monitoring and Maintenance

4.5.1 General

A designated official or responsible party should annually inspect and review the condition of all drill sites, access road/pipeline ROW'S, and any other disturbed areas associated with the project. This official should assess the success of and prognosis for all runoff and erosion control and revegetation efforts, evaluate fugitive dust control needs, and recommend remediation measures, if necessary. In addition, monitoring should take place following each major runoff event. Photographs should be taken at drill sites and along access roads at specific areas each year to document the progress of the reclamation program at established photomonitoring points.

The following specific items should be monitored during inspections:

- revegetation success;
- sheet and rill erosion, gullies, slumping, and subsidence;
- soundness and effectiveness of erosion control measures;
- sediment filtering devices along all active ephemeral and intermittent drainage channels;
- water quality and quantity;
- invasive, non-native species invasion;
- degree of rodent damage on seed and seedlings;
- locations of unauthorized off-highway vehicle (OHV) access;
- soundness and effectiveness of OHV control structures;
- evidence of livestock or wildlife grazing; and
- overgrazing/trampling of riparian and wetland areas.

4.5.2 Reclamation Success Monitoring

Reclamation success should be based upon the objectives specified in this plan; therefore, monitoring should be tied to these objectives. The actual monitoring procedures for quantitative and qualitative evaluations of reclamation success should be implemented as specified by the BLM or other authorizing agencies.

Reclamation success should be monitored both in the short term (temporary reclamation) and in the long term (final reclamation). Monitoring of temporary reclamation measures should include visual observations of soil stability, condition, and effectiveness of mulching and runoff and erosion control measures and a quantitative and qualitative evaluation of revegetation success, where appropriate. Long-term reclamation monitoring should include visual observations of soil stability, condition of the effectiveness of mulching and runoff and erosion control measures, and a quantitative and qualitative evaluation of revegetation success.

Revegetation success should be determined through monitoring and evaluation of percent ground cover to include a measure of vegetal cover (by species), litter/mulch, rock/gravel, and bare ground. Ground cover should be documented at each 1-foot interval along a 100-foot line intercept transect. Seedling density and relative abundance should be determined by selection of plots at the 20-, 40-, 60-, and 80-foot marks on the transect. Grazing impacts should be assessed as an ocular estimate of the percent utilization along the transect.

Soil stability should be measured using an erosion condition class/soil surface factor rating method to numerically rate soil movement, surface litter, surface rock, pedestalling, flow patterns, and rill-gully formation. Information obtained through this rating system represents an expression of current erosion activity and can be used to reflect revegetation success as a function of soil stability.

The access road boundaries, pipelines, and unused portions of the drill sites should be monitored until attainment of 80 percent of predisturbance vegetative cover within five years of seeding. This standard should include 90 percent of the vegetative cover being comprised of desirable species and the erosion condition of the reclaimed area being equal to or in better condition than predisturbance conditions as prescribed under the Performance Standard section of this plan.

4.5.3 Wetland and Drainage Channel Crossings

Wetland areas and natural drainage channel crossings should be monitored for a minimum of three years for invasive, non-native species invasion and establishment of undesirable species. Invasive, non-native species should not be allowed to establish at any time. If found in a reclaimed wetland or drainage channel crossing, the invasive, non-native species should be removed. Undesirable species should not be allowed to establish. At the third year of monitoring, presence of undesirable species should be negligible. The lessee should maintain wetland areas and drainage channel crossings according to this standard throughout the development of an invasive, non-native species and undesirable species monitoring and eradication program.

4.5.4 Photomonitoring

Permanent photomonitoring points should be established at appropriate vantage locations that provide adequate visual access to drill sites, along pipeline and access road rights-of-way, and to ancillary facilities. Each photomonitoring point should be permanently marked with re-bar and identified on a topographic map of the area. The location of each point should be described in detail to assist in relocation from year to year. Photos should be taken at each photomonitoring point prior to initiation of construction. Photos, framing the same scene as previously taken, should be taken each year until reclamation standards have been met.