Appendix M – Reclamation Plan

Introduction

Reclamation of public land is required for any surface disturbing activity. A reclamation plan tailored to a specific surface disturbing activity will be required for Federal actions authorized, conducted, or funded by the U.S. Department of the Interior, Bureau of Land Management (BLM) that disturb vegetation and/or the mineral/soil resources. This appendix details the elements that need to be considered during project planning, project implementation, and post-disturbance steps required to assure timely and proper recovery of the site. The reclamation processes included in this appendix are specific to reclamation activities in sage-grouse core habitat areas proposed in this Record of Decision (ROD). For reclamation requirements outside of core habitat areas, please refer to the Reclamation Plan in the appropriate BLM resource management plan (RMP).

This plan provides a framework for project-specific and site-specific reclamation actions that guide land management toward a future condition for any surface disturbance in sage-grouse core habitat areas. Early coordination between the BLM and project proponents is necessary to produce a comprehensive, site specific plan. The site-specific reclamation plan will serve as a binding agreement between project proponents and the land management agencies for the expected reclamation condition of the disturbed lands and may be periodically reviewed and modified as necessary. The reclamation plan will include sufficient monitoring requirements, reports, and components to ensure sufficiency.

Although the proponent will typically develop the reclamation plan, appropriate BLM involvement in preplanning, data inventory, and approval is essential to develop the optimum reclamation proposal. Most determinations regarding what is expected should be made before the reclamation plan is approved and implemented. However, the BLM Authorizing Officer can modify a plan through adaptive management, to adjust to changing conditions or to correct for an oversight using the best available science; changes should be agreed upon by the project proponent. An approved reclamation plan and reporting obligations will be required prior to any surface disturbing activity.

A reclamation plan has several purposes. For sage-grouse core habitat areas, the following will be used to guide the process:

- Reclamation plans provide detailed guidelines for the reclamation process and fulfill federal, state, county, and other local agencies requirements. They can be used by regulatory agencies in their oversight roles to ensure that the reclamation measures are implemented, are appropriate for the site, and are environmentally sound.

- Reclamation plans will be developed on a project specific basis; implementation of reclamation plans will be used by the project proponent throughout the permitting process, interim reclamation, cessation of surface disturbing activities (final reclamation), and finally at bond release (for energy development projects). In turn, the BLM will use the reclamation plan as a basis to review and evaluate the success of the reclamation program.

- Reclamation plans should provide objectives and approved procedures to facilitate monitoring and compliance evaluations.

Ecological Site Description

To understand the variations across the landscape, Natural Resource Conservation Service (NRCS) has classified these different parts into units called ecological sites. Ecological site is defined as “a distinctive

kind of land with specific characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation." Any land inventory, analysis, and resulting management decisions require the knowledge of these individual sites and their interrelationships to one another on the landscape.

The ESD application provides the capability to produce automated ESD from the data stored in its database. An ESD is the official repository for all data associated with the development of forestland and rangeland ESD by the NRCS.

The data comprising an ESD is presented in four major categories:

- Site Characteristics – Identifies the site and describes the physiographic, climate, soil, and water features associated with the site.

- Plant Communities – Describes the ecological dynamics and the common plant communities comprising the various vegetation states of the site. The disturbances that cause a shift from one state to another are also described.

- Site Interpretations – Interpretive information pertinent to the use and management of the site and its related resources.

- Supporting Information – Provides information on sources of information and data utilized in developing the site description and the relationship of the site to other ecological sites.

This information and the ESDs the NRCS have developed to date may be found at the following website: http://esis.sc.egov.usda.gov/Welcome/pgECOLOGICALSITEDESCRIPTIONWelcome.aspx

Reclamation Goals to Restore Sage-grouse Habitat Areas

Goals:

- Short term goal: immediately stabilize disturbed areas and provide conditions necessary to achieve the long term goal.

- Long term goal: facilitate eventual ecosystem reconstruction to maintain a safe and stable landscape and meet the desired outcomes of the land use plan.

- Reclaim vegetative communities within disturbed areas that will mirror those of healthy communities as described in the ESD.

Reclamation Objectives in Sage-grouse Core Habitat Areas

Objectives:

- Restore vegetative cover and landforms sufficient to maintain healthy, biologically active topsoil; control erosion; and, minimize habitat loss during the life of the well, facilities, or other surface disturbing activities.

In addition:

- Provide conditions and use methods to allow for successful reclamation in the least amount of time relative to site condition.

- Accelerate the restoration of sage-grouse habitat components that may be outside of the project area to provide for sage-grouse population persistence in the area of disturbance.

- Return the land to the desired condition based on ESDs. This includes restoration of the landform and natural vegetative community, hydrologic systems, visual resources, and wildlife habitats. To ensure that the long-term objective will be reached through human and natural processes, actions will be taken to ensure standards are met for site stability, visual quality, hydrological function, vegetative productivity, and habitat function.

Pre-Disturbance Baseline Inventory

Pre-disturbance inventory is a critical part of reclamation planning and provides information on ecological structure and function. This should include inventory of wildlife habitat, species composition, watershed protection, and visual qualities; as well as, characteristics that underlie those values and functions – the plants, soil, and landscape features that may require restoration. The inventory establishes a framework for successful reclamation, monitoring, and evaluation (Norton et al. 2010).

The inventory includes two steps necessary to compile complete and accurate information:

1. Gathering existing site-specific information from reliable sources; and,
2. Evaluating on-site ecosystem function and characteristics that may require subsequent restoration (Norton et al. 2010).

Table M-1. Description of Baseline Inventory

Activity	Critical Components
Initiating baseline inventory	• Identify site location • Contact land manager/owner or agency • Consult soil survey maps • Determine ESD • Consult Wyoming Geographic Information Center (WyGISC) to access aerial photography in color, grayscale, or color infrared (CIR) • Identify wildlife presence or use • If state lands, contact Wyoming Department of Environmental Quality, Land Quality Division for guidelines and or permits.
Conducting baseline inventory	• Travel to site • Verify ESD and soil types • Record vegetation types and distribution on the site using an accepted method for collecting the data • Record topographical landforms and surface hydrological features • Take photographs to provide a visual reference • Document data gathering and photos with GPS coordinates.

– Norton et al. 2010

Reclamation Plan Requirements/Minimum Standards

Reclamation plans should incorporate the standards set forth in Wyoming BLM Reclamation Policy as described in IM WY-2012-032. In the future, this will be supported with more detailed guidance such as new reclamation bond standards, a statewide monitoring and reporting strategy, and sample templates for

both reclamation and non-native and invasive species management plans. Specific reclamation information and other technical guidance will be forthcoming and posted on the Wyoming Reclamation web site (http://www.blm.gov/wy.st/en/programs/reclamation.html).

Reclamation Best Management Practices for Sage-grouse Habitat

Habitat reclamation will be initiated, and subsequently supplemented as necessary, to meet reclamation standards within all areas of sage-grouse habitats affected by soil disturbing activities.

Vegetation Management

Avoid disturbance in areas providing the best attributes for sage-grouse nesting, brood rearing, and wintering habitat (i.e., dense stands of sagebrush) when siting the location of a proposed action.

Reduce vegetation damage during reclamation in adjacent areas of sage habitats.

Choose native seed mixes that will provide a height to cover ratio to provide the maximum nesting cover. Where native seed mixes of local genotype are not available, consider the use of appropriate cultivars of native species.

Plan time of year for seed planting based on the optimal growing conditions for that species, site specific conditions, and the environmental conditions of that growing season.

Reference the Upper Green River and Sage-grouse Working Group Beneficial Seed Matrix for Sage-grouse, Mule Deer and Antelope:

http://gf.state.wy.us/wildlife/wildlife_management/sagegrouse/UpperGreenRiver/Index.asp
http://gf.state.wy.us/wildlife/wildlife_management/sagegrouse/Northeast/index.asp

Species used solely for site stabilization should be sterile, or a species unlikely to persist as natives are established.

The land management agencies do not recommend using a cover crop in areas with precipitation less than ten inches, as some cover crop species are not recommended for use in areas below 12 inch precipitation; local land management agencies, the NRCS, or other experts should be consulted for site-specific recommendations on cover crop species.

Additional Monitoring Components

Project proponent should start post-disturbance collection of cover and composition data in the first growing season after disturbance. Data must be collected using repeatable methods approved by the appropriate land management agency and will be the same methods that were used to describe vegetation for baseline (or reference area). The same methods will be used each time the vegetation is monitored.

Pre-Development Habitat Management

Use native site seed collection and local seed sources to the maximum extent practicable to maintain genetic diversity of local plant populations. Consider the use of cultivars of native species in the absence of sources of native seeds.

Exceptions

To facilitate reclamation seeding during the optimal growing seasons, exceptions may be approved providing that the exception granted would minimize surface disturbance outside of the action area.

Proponent Agreements

The land management agencies will encourage cooperative agreements between the agencies, proponent project proponents, and interested proponents so as to ensure the success of habitat reclamation.

Criteria for Determining Reclamation Success

The end result of reclamation success is the return of functional wildlife habitat (particularly to meet the sage-grouse each of the life stage requirements) within the disturbance area, as well as limiting the density of disturbance within the project impact analysis area (PIAA). By meeting the reclamation criteria below, a disturbance area would no longer count toward five percent loss of sage-grouse habitat in the density of disturbance calculations conducted by the BLM and Wyoming Game and Fish Department (WGFD).

A. The recently released Rangeland Ecological Site Interagency Manual (WO IB 2011-004) has the following objectives that address the use of ESD which include State and Transition Models:

- To implement a standardized system to define and describe a common unit for inventory, monitoring, evaluation, and management of rangeland ecosystems.

- To provide direction for the cooperative development and application of rangeland ESD.

B. The Rangeland Ecological Site Interagency Handbook (mentioned above) goes into detail on use of State and Transition Models and ESD, and can be used as a reference when developing reclamation plans using these methods.

C. The current BLM Handbook H-4180-1 contains references to ecological sites, ESD, and reference areas. The site potential is related to transitions and thresholds in the handbook. The handbook also recognizes the Ecological Site Index and ESD may not be available for all assessment areas, but that where they exist, they should be used. Other vegetation succession models are not mentioned in H-4180-1.

D. The National Range Handbook (H-4410-1) addresses State and Transition Models and ESD and can be used as a reference.

E. The NCRS Ecological Site Inventory Technical Reference (TR 1734-07) also discusses about succession and State and Transition Model pathways, and ESD.

F. The NRCS Riparian-Wetland Ecological Site Inventory Technical Reference (TR-1737-7) does the same.

If ESDs, which include State and Transition Models, are not written for the project site, the project proponent should work with the land management agencies, WGFD, NRCS, and other local experts to create these products.

Sage-grouse Habitat Requirements

Vegetative Criteria

Native Forbs: The average frequency of desirable forbs must be a minimum of 75 percent of the ESD reference site. Reference sites must be selected in areas of the same ESD and must be mutually agreed upon

with the land management agency and WGFD. If this is not possible, the desired plant community for the site may be used. Diversity of forbs on a reclaimed site must be equal to or greater than pre-disturbance composition. Timeframes to determine whether replanting or developing another strategy to meet native forb establishment will be determined upon establishing the ESD.

Native Shrubs: The average frequency of the shrub component must be at least 50 percent of the ESD reference site. This includes both shrubs and sub-shrubs (e.g., winterfat (*Krascheninnikovia lanata*), fringed sage (*Artemisia frigida*), etc.). At least 15 percent density or frequency of the shrub component must be by the dominant species relative to pre-disturbance composition. The diversity of shrubs must be equal to or greater than the desired plant community. Timeframes to determine whether replanting or developing another strategy to meet native shrub establishment will be determined upon establishing the ESD.

Native Grasses: Reclaimed sites must have growth forms and plant diversity representative of the ESD reference site. These are to be planted at rates appropriate to achieve abundance and diversity characteristic of those found in the ESD reference site. Timeframes to determine whether replanting or developing another strategy to meet native grass establishment will be determined upon establishing the ESD.

Non-Native and Invasive Species: Reclaimed sites must be free from all species listed on the Wyoming Noxious Weed List. All local, state, and federal invasive[8] plant laws and regulations must be adhered to. Other highly competitive invasive plants, such as downy brome grass, will be controlled. Site specific weed management plans will address management goals and priorities.

Plant Vigor: Plants must be resilient as evidenced by well-developed root systems, flowers, and seed heads. All sites to be considered reclaimed must exhibit the sustainability of the above desired attributes. A minimum of one growing season without external influences (irrigation, mat pads, fences, etc.) may satisfy this requirement.

Final Reclamation Criteria

Ground Cover and Ecological Function

To ensure soil stability and nutrient cycling, canopy must be equal to or greater than the pre-disturbance composition and vegetative litter must be decomposing into the soil.

Vegetative Criteria

Native Forbs: The average percent composition and total diversity of forbs must be equal to or greater than pre-disturbance composition. Timeframes to determine whether replanting or developing another strategy to meet native forb establishment will be determined upon establishing the ESD.

Native Shrubs: The average frequency of the shrub component must be at least 80 percent of pre-disturbance composition within eight years. This includes both shrubs and half shrubs (e.g. winterfat, fringed sage, etc.). At least 25 percent density or frequency of the shrub component must be the dominant species from the reference site. The diversity of shrubs must be equal to or greater than the reference site.

Native Grasses: Reclaimed sites must exhibit grass percent composition equal to the reference site. Timeframes to determine whether replanting or developing another strategy to meet native grass establishment will be determined upon establishing the ESD.

[8] Invasive species. A species that is not native (or is alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112).

Non-Native/Noxious/Invasive Weeds: Sites must be free from all species listed on the Wyoming and Federal noxious weed list. All state and federal laws regarding non-native species and noxious weeds must be followed. Aggressive action to eliminate highly competitive invasive species such as cheatgrass and other invasive brome grasses must be taken to prevent spread.

Plant Vigor: Plants must be resilient as evidenced by well-developed root systems and flowers. Shrubs will be well established and will exhibit age class structure.

An Alternative Determination for Reclamation Success

Standards for success will be developed based on performance based criteria and the ESD. Locations where the site provides sage-grouse habitat during all life stages; will have criteria developed based on habitat requirements for sage-grouse. Criteria may be developed based on the nesting, early and late brood-rearing, and winter concentration habitats. If the site has insufficient soil attributes or other components to provide sage-grouse habitat based and the ESD confirms that you will never have attributes that provide for sage-grouse habitat, the reclamation can be deemed a success as long as it meets the ESD. The objectives for each reclamation plan are set with site specific criteria at the field office level, thereby maximizing the unique conditions within each field office.

Monitoring

1. Standard Monitoring Requirements:

a. Project proponents must use the same locations and methods used at baseline for repeat photography. Additional locations may be selected to document progress of reclaimed area to demonstrate interim[9] and final reclamation[10] success, and to monitor any identified problems such as erosional features. The site should be photographed once every year normally at the same time period, from the same locations and direction so that photographs are repeated through time. Photographs should be taken during the growing season.

b. Weed inventory: Disturbed and reclaimed areas will be evaluated for noxious and invasive weeds annually until the timeline determined by the ESD has been satisfied. A weed control plan will be written separately under the BLM's Integrated Weed Management Program.

c. Erosion control/soil stability: The reclaimed area should be evaluated for any signs of erosion problems annually (until the timeline determined by the ESD has been satisfied) and when the site is subject to erosional events. Identified erosion features should be monitored using repeat photography. Absence of erosion features is a positive indication that the soil is stabilizing.

d. Hydrological function measurements should be documented using Technical Note #346 Erosion condition classification system and the determination of erosion condition class sheet to ensure the of erosion control methods worked during the development phase and the final pad contouring; resulting in the return of the original hydrologic function of the site.

[9] Interim reclamation may proceed if a project will be dormant for an undetermined amount of time, to provide cover to prevent erosion events and to provide forage for wildlife).

[10] Final reclamation occurs when all activities on the location have been completed, recontouring occurs and the seed mix contains all species necessary for habitat recovery.

e. Restoration of the landforms visual resource should also be documented, whether returning the location to the original visual classification under the RMP or the original topographic features.

f. Wildlife habitat communities should be monitored to ensure that the goals for sensitive wildlife species are also being met. The following tools may be used to include parameters that may not be necessary in the ESD but are useful in documenting wildlife habitat potential:

- Important Wildlife Habitats: http://gf.state.wy.us/downloads/pdf/og.pdf
- Sage-grouse range wide forum links: http://sagegrouse.ecr.gov/?link=110
- Recommendations for Development of Oil and Gas Resources within Big Game Crucial and
- Important Habitats: http://gf.state.wy.us/downloads/doc/O&G%20Recommendations%20April%202010%20with%20changes%20identified.pdf

2. Reclamation actions will be initiated before the first growing season following disturbance.

3. Following each growing season:

a. Review and complete a site-specific vegetation monitoring report for areas being reclaimed.

b. Prepare a written, site-specific prescription for actions to be implemented, including:

- Reseeding of areas not attaining reclamation success
- Soil stabilization
- Weed control needs
- Mulching/fertilization or other cultural practices prescribed for the following season.

4. If the treatment area is found, through site-specific monitoring data, to be successfully reclaimed, monitoring to confirm reclamation success will continue until the timeline determined by the ESD has been satisfied. The site will also comply with additional management needs, including control of weed infestations.

5. Within one to three years of initiation of reclamation, sites will demonstrate the establishment of a viable desirable seedling frequency. (Pro-action may want to be taken if reclamation is not successful during a good moisture year.) Desirable seedling density or frequency, compared to pre-disturbance composition information, shall consist of a vigorous, diverse, native (or otherwise approved) plant community or ecologically comparable species as approved by BLM's Authorizing Officer (AO). If this does not occur the project proponent should coordinate with the BLM, NRCS, WGFD, or other local experts to determine an alternative course of action to ensure full site recovery, the actions prescribed will be implemented as planned and further monitoring will occur as detailed beginning with the first action listed above.

If at any time pre-disturbance composition data is not suitable for reclamation success determinations, the project proponent may select a desired plant community in the reference state from the ESD State and Transition model.

Reporting

The project proponent will provide the BLM with an annual report for all sites disturbed. The report will include:

- Copies of the completed individual site review forms or a BLM-approved electronic report.

- A summary of monitoring data and results, including:

  - Individual site reclamation monitoring reporting data (Table A36-1)
  - Identification of sites successfully reclaimed by reclamation years (starting with the first growing season)
  - Identification of sites needing additional work or more reclamation activities (adaptive management) by reclamation year
  - Sites proposed for the end of monitoring (i.e., sites that were successfully reclaimed).

- The BLM's useable shape file(s) or geographic information system (GIS) layer(s) that details location, name, type, and extent of:

  - New disturbances
  - Unreclaimed disturbance
  - New reclamation
  - Failed or unsuccessful reclamation
  - Locations of noxious/invasive weed infestation
  - Further vegetation treatments planned (e.g., mulching, matting, and weed control).

On these shape files or GIS layers, *location* shall be given as the legal location and geo-referenced location of the site; *name*, as appears on the BLM's Application for Permit to Drill (APD), lease, or other BLM file name for the site; *extent*, as the appropriate component boundary.

QUALITATIVE MONITORING SHEET

Well Name/ Number _____

Monitoring Date _____

Company _____

Inspector _____

☐ Well Pad ☐ Access Road ☐ Pipeline ☐ Other _____

Topsoil Storage ☐ Stockpile (> 3ft) ☐ Stockpile (< 3ft) ☐ Direct Haul ☐ None

Length of Topsoil Storage (months) _____

Seeding Method ☐ Broadcast ☐ Drill ☐ Other _____

Date Seeded_____ Seed Mix_____

Soil Amendment_____ Date of Amendment Application_____

Item	Monitoring Requirement	Description	Yes	No
1	Is seed germination apparent?	Seeds have germinated, seedlings are emerging.		
2	Is the area free of undesirable materials?	Trash, construction materials, etc.		
3	Is the soil stable with no indications of subsidence, slumping and/or significant erosion?	Rills greater than 2 inches, accelerated erosion is obvious and soils are not being held by plants on site, sheet flow, head cutting in drainages, slopes occurring on or adjacent to reclaimed areas.		
4	Absence of noxious weeds?	Perennial pepperweed, Canada thistle, black henbane, leafy spurge, yellow or Dalmatian toadflax, spotted knapweed, Russian knapweed, etc.		
5	Absence of other undesirable species?	Cheatgrass, Halogeton, Russian thistle, etc.		
6	Is there evidence of good reproductive capability?	Seed production is evident. Amount of tillers, rhizomes, flowers, and/or seed stalks are comparable to the reference site. To answer yes, must have for all three plant types: grass, forb, and shrub.		

Item 7: Year of Reclamation

☐ Years 2 - 3 ☐ Years 4 - 5 ☐ Years 6 -7 ☐ Years 8+

If any of the items are answered "No" above, please identify the problem, attach explanation and photographs, and contact BLM Reclamation Specialist.

Well name and number:_____ **Date:**_____

Operator:_____ **Collector:**_____

Erosional Feature	Potentially Present Yes/ No	Identified Factors (Form 7310-12)	Possible Factor
Soil Movement			14
Surface Litter			14
Surface Rock Fragments			14
Pedestalling			14
Flow Patterns			15
Rills			14
Gullies			15
Column Totals			
Soil Surface Factor Total			
Class			

SSF	Class
1-20%	Stable
21-40%	Slight
41-60%	Moderate
61-80%	Critical
81-100%	Severe

Procedure:

1. Observe the total sample area and determine an average condition for each of the seven items above.
2. Determine if each item is potentially present as only these items will be considered.
3. For the items potentially present, indicate appropriate numerical value. (Form 7310-12)
4. Total both the weighted values and the potential values for each item.
5. Calculate the total percent SSF: (identified factors/ possible factors) X 100.
6. Indicate corresponding condition class site is in.

Comments:

Form 7310-12
Determination of Erosion Condition Class
Soil Surface Factor (SSF)

Well Name/Number: _____ Date: _____

Operator: _____ Collector: _____

Soil Movement	Depth of recent deposits around obstacles, or in microterraces; and/or depth of truncated areas, is 0 – 0.1 in (0 – 2.5 mm). **0 or 3**	Depth of recent deposits around obstacles, or in microterraces; and/or depth of truncated areas, is 0.1 – 0.2 in (2 – 5 mm). **5**	Depth of recent deposits around obstacles, or in microterraces; and/or depth of truncated areas, is 0.2 – 0.4 in. (5 – 10 mm) **8**	Depth of recent deposits around obstacles, or in microterraces; and/or depth of truncated areas, is 0.4 – 0.8 in. (10 – 20 mm) **11**	Depth of recent deposits around obstacles, or in microterraces; and/or depth of truncated areas, is > 0.8 in. (20 mm) **14**
Surface Litter	No movement, or if present, < 2% of the litter has been translocated and redeposited against obstacles. **0 or 3**	2 – 10% of the litter has been translocated and redeposited against obstacles. **6**	10 – 25% of the litter has been translocated and redeposited against obstacles. **8**	25 – 50%% of the litter has been translocated and redeposited against obstacles. **11**	> 50% of the litter has been translocated and redeposited against obstacles. **14**
Surface Rock Fragments	Depth of soil removal around the fragments, and/or depth of recent deposits around the fragments is < 0.1 in (2.5 mm). **0 or 2**	Depth of soil removal around the fragments, and/or depth of recent deposits around the fragments is 0.1 – 0.2 in. (2.5 – 5 mm). **5**	Depth of soil removal around the fragments, and/or depth of recent deposits around the fragments is 0.2 – 0.4 in. (5 – 10 mm). **8**	Depth of soil removal around the fragments, and/or depth of recent deposits around the fragments is 0.4 – 0.8 in. (10 – 20 mm). **11**	Depth of soil removal around the fragments, and/or depth of recent deposits around the fragments is > 0.8 in. (20 mm). **14**
Pedestals	Pedestals are mostly < 0.1 in (2.5 mm) high and/or have a frequency < 2 pedestals/100 ft. **0 or 3**	Pedestals are mostly 0.1 – 0.3 in. (2.5 – 8 mm) high and/or have a frequency of < 2 – 5 pedestals/100 ft. **6**	Pedestals are mostly 0.3 – 0.6 in. (8 – 15 mm) high and/or have a frequency of < 5 – 7 pedestals/100 ft. **9**	Pedestals are mostly 0.6 – 1 in. (15 – 25 mm) high and/or have a frequency of < 7 – 10 pedestals/100 ft. **11**	Pedestals are mostly > 1 in. (25 mm) high and/or have a frequency of > 10 pedestals/100 ft. **14**
Flow Patterns	If present, < 2% surface area shows evidence of recent translocation and deposition of soil & litter. **0 or 3**	2 – 10% surface area shows evidence of recent translocation and deposition of soil & litter. **6**	10 – 25% surface area shows evidence of recent translocation and deposition of soil & litter. **9**	25 – 50% surface area shows evidence of recent translocation and deposition of soil & litter. **12**	> 50% surface area shows evidence of recent translocation and deposition of soil & litter. **15**
Rills	If present, are < 0.5 in (13 mm) deep and at intervals > 10 ft. **0 or 3**	Rills are mostly .5 – 1 in. (132 – 25 mm) deep, and at intervals >10 ft. **6**	Rills are mostly 1 – 1.5 in. (25 – 38 mm) deep, and at intervals > 10 ft. **9**	Rills are mostly 1.5 – 3 in. (38 – 76 mm) deep, and at intervals >10 ft. **12**	Rills are mostly 3 – 6 in. (76 – 152 mm) deep, and at intervals > 5 ft. **14**
Gullies	If present, < 2% of the channel bed and walls show active erosion (no vegetation), gullies make up <2% total area. **0 or 3**	2 – 5% of the channel bed and walls show active erosion (no vegetation), gullies make up 2 – 5% total area. **6**	5 – 10% of the channel bed and walls show active erosion (no vegetation), gullies make up 5 – 10% total area. **9**	10 – 50% of the channel bed and walls show active erosion (no vegetation), gullies make up 10 – 50% total area. **12**	Over 50% of the channel bed and walls show active erosion (no vegetation), gullies make up >50% total area. **15**

ATTACHMENT A—RECOMMENDED RECLAMATION PRACTICES FOR ENSURING SUCCESSFUL AND TIMELY ECOSYSTEM RECLAMATION IN SAGE-GROUSE HABITAT

Recommended Best Management Practices for Handling Suitable Soils to Maintain Soil Quality

Suggestions on Stockpiling Suitable and Unsuitable Soils to Maintain Soil Quality

The methods suggested in this section have been documented to improve reclamation success; however it is up to the project proponent to utilize their judgment, expertise, and the latest research and information to achieve desired results.

Stockpiled topsoil should not be piled too deeply or too shallow. The taller or deeper the piles the more soil is buried under large amounts of pressure resulting in compaction. Soil buried deep in the pile also has little exposure to oxygen resulting in anaerobiosis; deeply buried soil also has no organic matter input. Both of these problems reduce soil quality.

Shallow or small topsoil stockpiles have large footprints on the land surface with the disadvantage of covering greater areas of undisturbed soil which will, in turn, require revegetation, resulting in a greater overall amount of disturbed soil. Smaller or shallow stockpiles also have a greater surface area per amount of soil stored which increases exposure of the stockpiled soil to wind and water erosion. The surface of soil stockpiles should always be vegetated to minimize erosion losses.

- Salvaged stockpiles of suitable soil should be no deeper than four meters (13 feet) and should be less where possible with the understanding that greater surface disturbance may occur.

- Stockpile slopes should not exceed 5:1 angles (20% slopes) to allow for seeding and minimize erosion.

- Suitable soil stockpiles should be located in areas to prevent their disturbance and contamination by project activities. They should not be placed in streambeds or ephemeral drainages where they may be washed away. They should be protected from wind erosion.

- A perimeter ditch/berm can be constructed around the stockpile for topsoil conservation and sediment control where necessary.

- All suitable soil stockpiles should be seeded with native cool season grass to provide cover and protect them from water and wind erosion. Before seeding, the stockpile may be scarified along contours to minimize wind and water erosion.

- If soil horizons or layers are to be stratified during soil salvage (stripping) operations, soil maps should be made of the well pad area to identify depths of soil horizons and surface slope. The area to be cleared of soils should then be divided into strips the size of the blades or equipment being used for soil removal. The depth of soil removal from each swath should be clearly marked so that equipment operators are removing a uniform layer from each strip. After the topsoil is removed from the area in this manner, the subsoil can then be removed in the same fashion, strip by strip, each strip at a uniform depth.

Soil Amendments

- Soil amendment(s) may be used in reclamation if the soil is lacking the necessary chemical, biological, physical and /or organic materials to support sustaining growth of suitable plant materials. The soil type, soil characteristics, geographic location, along with soil mapping resources available should provide the information necessary to define the soil amendment.

- The Project Proponent should state what applying soil amendments is intended to accomplish. Soil amendment plans should be provided, including what amendments will be applied, method of application, and timing relative to other reclamation activities (i.e. stockpiling, seeding, and ripping).

- The soil type is defined by the soil samples obtained prior to, or in some cases, after disturbance takes place. Soil amendments must be scientifically calculated based on the soil characteristics so as to provide the most cost efficient and best assurances for successful reclamation.

- Soil amendments include but are not limited to the following: Weed free grass hay, weed free wood chips or other weed free cellulosic materials, gypsum, elemental sulfur, and fertilizer.

Suggestions on Vegetation and Soil Monitoring

Examples of monitoring components are listed below:

- Reference: http://agriculture.wy.gov/forms/natres/rangelandmonitoring.pdf

Suitable Soil Inventory

- Soil characteristics may strongly influence reclamation efforts. Fundamental characterization of soils ahead of disturbance can identify potential problems, so they can be addressed during disturbance, soil stockpiling and reclamation, instead of waiting for reclamation failure.

- The phrase "suitable soil" is used mainly because of confusion over the definition of topsoil. Soil depth, pH, electrical conductivity, texture, surface features (e.g. barren, rocky, crusty, plant litter), and organic matter content are characteristics that may be used to determine if a soil is suitable. Other information may be needed. See: "Successful restoration of severely disturbed lands: Overview of critical components," B-1202, (and available for free at http://ces.uwyo.edu/PUBS/B1202.pdf.).

- Soil characteristics that can signal a high probability of reclamation problems include: pH, electrical conductivity, soil texture, surface/subsurface features, sodium adsorption ratio, calcium carbonate content, soil compaction, and saturation percentage. The listed characteristics below will be addressed by the Proponent in the site specific reclamation plan approved by the BLM.

    - Soils with pH 7.8 and higher progressively become less suitable for reclamation and will be addressed by the Operator in the site specific reclamation approved by the BLM.
    - An electrical conductivity of soil greater than eight deciSiemens per meter (dS/m) and any increase in salt content of the soil above 0.5 dS/m will progressively negatively affect the establishment and growth of plants. Soils exhibiting these characteristics will be addressed by the Operator in the site specific reclamation plan approved by the BLM.
    - Soils with textures representing clay, sand or loamy sand will be addressed by the Operator in the site specific reclamation plan approved by the BLM.
    - Surface and subsurface soil in and through the root zone dominated by coarse material greater than two millimeters in diameter and greater than 40 percent in the soil profile to be stockpiled may signify reclamation difficulties and will be considered in the site specific reclamation plan by the BLM and Proponent.

- Sodium adsorption ratio (SAR) is a key diagnostic soil trait that may be determined for soils to be disturbed and placed in the suitable soil stockpile; and will be addressed by the Operator in the site specific reclamation plan approved by the BLM.
- Calcium carbonate content (percent lime) will control the amount of plant available phosphorus and will determined in the site specific reclamation plan by the Operator and approved by the BLM.
- The soil saturation percentage will control the ability for plants to germinate and survive after reclamation actions have been taken by the Operator and will be addressed by the Operator in the site specific reclamation plan approved by the BLM.

Site Preparation

It is important to consider diversity in seedbed preparation to account for various seed sizes and establishment strategies of different species. Consideration should be given for seed-safe sites, water infiltration and collection, shade, and frost protection.

Recontouring

Trees, shrubs, and ground cover adjacent to disturbance areas but not cleared from rights-of-way (ROW) require protection from construction damage. Recontouring to preconstruction condition as well as restoration of normal surface drainage is required.

Road Reclamation Guidelines

Road reclamation guidelines are as follows:

- Determine the desired level of obliteration and reclamation. Determine whether there are alternative short- or long-term uses for roads.

- Determine short- and long-term reclamation objectives and goals. Identify the monitoring methods to determine reclamation success or failure and possible mitigation.

- Reclaim the road; the effort may include ripping and scarifying the surface, removing culverts and other flow structures, recontouring cut and fill slopes to provide for complete removal of the road, and total recontouring to the original topographic profile.

- Reclaim vegetation to standards outlined in the section on “criteria for reclamation.”

- Establish mitigation measures to remedy problems identified by monitoring.

Non-Native and Invasive Species

One of the land management agencies’ highest priorities is to promote ecosystem health, and one of the larger obstacles to achieving this goal is the rapid expansion of non-native and invasive species across public lands. Invasive plants can dominate sites and often cause long-term changes to native plant communities. If not eradicated or controlled, invasive species will jeopardize the success of reclamation. Invasive species can slow reclamation success or halt it altogether. Right-of-Way (ROW), mineral lease, mining claim, and permit holders are required to monitor and control invasive species on public land as stipulated within their permits and authorizations.

Invasive Plant Management Plan for Construction and Reclamation Activities

Disturbed sites can provide ideal opportunities for invasive plant species to propagate. Invasive plants can be transferred to the disturbed site from adjoining areas and out-compete desired vegetation during reclamation and/or spread to new areas. The best approach to combat invasive species is to use careful suitable soil handling and an appropriate seed mix. Pre-disturbance planning, including early weed management for invasive species is vital to reduce costs and ensure successful reclamation.

- Assess for noxious and invasive weed species before initiating surface disturbing activities, during disturbance, during interim and final reclamation, and after reclamation is completed.

- Web address for the Wyoming Weed and Pest Council: http://www.wyoweed.org/.

- Apply invasive species control treatments.

    - Consider clipping or shredding invasive plants to prevent re-seeding or nuisance to neighbors, when developing control treatments (NRCS 2001).

- Monitor invasive plant species at least annually to evaluate success of control treatments and determine if continued treatment is necessary.

The vegetation will consist of species included in the seed mix and/or occurring in the surrounding natural vegetation or as deemed desirable by land management agencies in review and approval of the reclamation plan. No single species will account for more than 30 percent total vegetative composition unless it is evident at higher levels in the adjacent landscape. Vegetation canopy cover production and species diversity shall approximate the surrounding undisturbed area.

Seed

On all areas to be reclaimed, seed mixtures are required to be certified noxious weed free and site specific, composed of the same native species as determined in the Desired Plant Community/ESD or early successional species consisting of pioneer species, including seasonal or annual species (that may only be evident at certain times of the year), that will lead to a similar climax community as that disturbed. Site preparation and species choices must ensure soil stability.

A Desired Plant Community/ESD species composition list must be developed for each site to ensure proper community composition, function, and structure. This will ensure that the type of vegetative community replaced is compatible with climate and soil types and should make it easier for the project proponent to successfully restore and stabilize specific sites.

Livestock palatability and wildlife habitat needs should be given consideration in seed mix formulation during reclamation within areas of important wildlife habitat (crucial winter range, sage-grouse nesting habitat, etc.); provision shall be made for the replacement of native browse and forb species. Bureau of Land Management guidance for native seed use is the BLM Manual 1745 and Executive Order (E.O.) 13112 (Invasive Species, 64 Code of Federal Regulations [CFR] 6183). In addition, specific seed mix recommendations appropriate to restore sage-grouse habitats are included at the end of this appendix from the NE and Upper Green River Sage-grouse Working Groups.

Describe Seeding Methods

- Different plant species may require different conditions (e.g. seeding depth, seed scarification, mixing, and timing) for optimal germination success. Seeding methods should match germination

characteristics of species in the seed mix and consider timing of planting to maximize germination and establishment of all reclamation species.

- The Proponent will describe when seeding will occur and specify the methods they will use for seeding, including differential handling for different species (e.g. broadcast vs. drilling vs. imprinting), and seeding depth in the site specific reclamation plan. Re-seeding may need to occur if invasive and/or noxious weeds prevent establishment of the seed mix.

A germination test for Pure Live Seed (PLS) basis should be used (http://efotg.sc.egov.usda.gov/references/public/WY/pm6.pdf).

Germination Test

A germination test samples for total viability, including the sum of all seeds (of a "kind" listed on the label) actually germinating using standard laboratory methods + hard seed and/or dormant seed.

Percent Germination: A germination test determines the capability of a seed lot to produce normal seedlings under favorable controlled conditions. Total germination is the percent germination added to the percent hard and/or dormant seed. Anything under 100 percent total germination represents the presence of dead seed and/or seed that doesn't produce a shoot or root. Germination may also be estimated by the use of a tetrazolium chloride test (TZ test) in which seeds are stained with a dye to determine viability. Viable seed with live (respirating) tissues will stain a red color. However, not all states recognize the use of a TZ test for all species.

Dormant Seed: Includes hard seed, refers to the portion of the seed sample that doesn't germinate during the seed test. Reasons for dormant seed are: 1) the seed coat is impervious to water, and/or 2) internal structures within the seed prohibit oxygen exchange. Hard seed may germinate at a later date and produce a viable plant, or it may germinate and succumb to competition, or it may never germinate at all.

The higher the germination percentage, the better. Germination of most grass species is normally above 80 percent and should not be lower than 60 percent. Germination of some native grasses, forbs, and shrubs may be lower, but can vary widely according to species.

The germination test date should also be current. Grass, forb and legume seed should be updated every nine to 18 months depending on state laws. Flower, shrub, and tree seed should be updated every nine months.

Standard Seed Mixtures

Care and planning must be taken to choose mixes and amounts that will benefit under site-specific conditions. Planning and thought must also go into selecting successful planting and site-preparation techniques. All sites must be planted with a diverse mix of grasses, forbs, and shrubs to be considered successful. The project proponent is ultimately responsible for successful restoration of disturbed sites. Seed mixes should be based on and the Desired Plant Community that is achievable according to the ESD. When appropriate native plant materials are not commercially available, use of local collections or adapted species that perform similar function may be used in lieu of the exact species described the ESD that has been shown to be successful in previous trials. Return of cover should be gauged by comparison with actual pre-disturbance site conditions and/or reference areas. Alternate seed mixes can be submitted by the project proponent to the BLM for review and approval prior to use. The final goal is to restore disturbed sites so that they closely resemble predisturbance native plant communities. Some standard seed mixes are available for the Field Office and contain only native species. If the use of a non-native species is desired, documentation of the need is required by the BLM policy. Non-native species may be considered for erosion and weed control. Seed mixtures consisting of sterile annual cover crops, such as tricale hybrid, can be

used. Non-native species may be considered in some circumstances to aid the revegetation of native species as outlined in the Wyoming Reclamation Plan. As stated in the Wyoming Reclamation Plan (IM WY2012-032) "Select non-native plants only as an approved short term and non-persistent (i.e. sterile) alternative to native plant materials. Ensure the non-natives will not hybridize, displace, or offer long-term competition to the endemic plants, and are designed to aid in the re-establishment of native plant communities." Follow-up seeding or corrective erosion control measures will be required on areas of surface disturbance that fail to meet reclamation success standards within a reasonable time.

Seed Mixes

The need to provide multifunctional and sustainable seed mixes for interim and final reclamation and soil stability is driven by a desire to increase potential for successful and timely re-vegetation and site stability. Plant diversity and habitat functionality are directly impacted by the seed choices applied to an area slated to be reclaimed or restored. To maintain as much stability and ecological function this section makes recommendations to specifically aid a proponent's selection process.

- Select site-appropriate, adapted native plant materials based on the ESD, Desired Plant Community, and commercially available native species adapted to the species identified in the Desired Plant Community/ESD. Seeds may be obtained from commercial sources of certified weed-free seed mixes. Alternatively, local collections may be used provided they are collected in an area without weedy species. Any seed used for reclamation should be certified weed free and have the same standards required as commercially purchased seed.

- Perennial naturalized species may be used when attempts to reclaim using native plants have not succeeded for a minimum of five full growing seasons. Reclamation should succeed using native species if soils are properly managed, precipitation is not limiting, seed mixes are carefully selected, and seeded areas protected from grazing.

- Based upon site-specific conditions, a decision may be made to use non-natives sooner than identified above and will be used in only unique conditions defined in the site specific reclamation plan, and approved by the Authorizing/Line Officer.

Mulch

Use of mulch during reclamation may enhance chances for successful vegetation reestablishment. Mulches can help control wind and water erosion, retain and collect seed, increase and prolong soil water capacity, and add organic compounds to the soil. Mulches are best applied after seeding to ensure proper seed contact with soil. Mulch may include hay, small-grain straw, wood fiber, live mulch, cotton, jute, or synthetic netting. Straw mulch should contain fibers long enough to facilitate crimping and provide the greatest cover.

When mulching with cereal grain straw or grass hay, apply in sufficient amounts to provide 70 percent ground cover. Mulch rate shall be determined using current erosion prediction technology to reach the soil erosion objective (NRCS 2005).

When mulching with wood products such as wood chips, bark, or shavings or other wood materials, apply to a 2-inch thickness if the soil is not well-drained and to a 3- to 4-inch thickness if drainage is good. More finely textured mulches, which allow less oxygen penetration than coarser materials, should be no thicker than one or two inches. The mulch material shall provide no greater than 80 percent ground cover in order to ensure adequate air drainage (NRCS 2005).

Gravel or other inorganic material shall be applied approximately two inches thick and shall consist of pieces 0.75 inch to two inches in diameter. The mulch material shall provide no more than 90 percent ground cover in order to ensure adequate air drainage (NRCS 2005).

Mulch shall be applied at a rate that achieves 50 percent ground cover to provide protection from erosion and runoff and yet allow adequate light and air penetration to the seedbed to ensure proper germination, emergence, and disease suppression (NRCS 2005).

Any mulch used must be certified free from noxious or invasive weed seeds.

Live Plantings

Live plants can be planted on disturbed sites and, with proper site preparation, can greatly enhance restoration efforts and shorten time frames. Proponents can buy bare root and container stock directly from vendors or can contract seed collection and growth from local growers. Another strategy is to use an excavator to collect clumps of plants from the site and plant them either on reserved topsoil piles and/or on restoration sites during recontouring. These clumps can provide native seed and soil flora as well as collect precipitation and provide shade for newly emerging plants.