Appendix A
Greater Crossbow Oil and Gas Exploration and Development Project

Programmatic Reclamation Plan

Prepared for

EOG Resources

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1.0 INTRODUCTION

This Programmatic Reclamation Plan for the Greater Crossbow Oil and Gas Exploration and Development Project (Project) provides an overview of the reclamation goals and standards that will be used to ensure successful reclamation of disturbed areas created by the Project. These reclamation procedures are designed to establish the potential methodologies, monitoring, and reporting standards for reclaiming disturbances associated with this Project and were developed in accordance with the following documents.

- Wyoming Oil and Gas Conservation Commission (WOGCC) Guideline for Reclamation of Surface Areas Disturbed by Oil and Gas Drilling or Production Operations (WOGCC 2002)
- Bureau of Land Management (BLM) Buffalo Field Office Resource Management Plan (BLM 2014a)
- BLM Record of Decision and Approved Casper Resource Management Plan (BLM 2007)
- U.S. Forest Service (USFS) Medicine Bow National Forest, Routt National Forest, and Thunder Basin National Grasslands Land and Resource Management Plans (USFS 2015)
- EOG Resources, Inc. (EOG) Environmental Handbook Powder River Basin (EOG 2015)
- BLM Wyoming Reclamation Policy (BLM 2012)
- BLM Draft Wyoming Sage-grouse Land Use Plan Amendment (BLM 2014b)
- U.S. Department of the Interior (USDOI) Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, also known as the "Gold Book" (USDOI and U.S. Department of Agriculture [USDA] 2007)
- Wyoming Department of Environmental Quality (WDEQ), Land Quality Division (LQD) Reclamation Guidelines (WDEQ 2007)
- Wyoming Game and Fish Department (WGFD) Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats (WGFD 2010)
- Wyoming Reclamation and Restoration Center (WRRC) Handbook of Western Reclamation Techniques (WRRC 2006)
- U.S. Forest Service (USFS) Thunder Basin Grasslands Land Use Plan (BLM 2015)
- EOG Resources, Inc. Field Wide Storm Water Pollution Prevention Plan (SWPPP) for Sweetwater, Campbell, Converse, and Laramie County, Wyoming

The Greater Crossbow Project Area is located in the southern extent of the Powder River Basin (PRB) and includes portions of southern Campbell and northern Converse counties in northeast Wyoming. The Project Area is between Wright and Bill, WY, and encompasses all or portions of ten townships including T42N:R734W - T42N:R71W, T41N:R734W – T41N:R71W, T40N:R72W – T40N:R71W, and T39N:R72W. The approximately 106,987 surface acres of the Project Area includes about 93,140 acres of privately owned lands (87% of the PA), 8,192 acres (8% of the PA) of State lands administered by the State of Wyoming, and 5,655 acres (5% of the PA) of federal lands managed by the U.S. Forest Service (USFS) Thunder Basin National Grasslands (TBNG). Of note, there is no BLM-administered surface within the Project Area.

This Programmatic Reclamation Plan and the procedures and standards outlined herein is intended to apply to all lands within the Project area. However, on private surface, all activities require the consent of the private surface landowner. Reclamation procedures in this document

outline measures that will be taken to effectively reclaim areas disturbed by the Project, minimize Project impacts to natural resources, and comply with federal and state regulations. For the purposes of this document, reclamation measures are presented in a general, non-specific manner. Detailed or site-specific reclamation measures and techniques will be developed at the APD stage. As previously stated, all reclamation activities would be conducted in accordance with the preferences of the private surface landowner.

1.1 DEFINITIONS AND OBJECTIVES

Reclamation objectives emphasize eventual ecosystem reconstruction to maintain a safe and stable landscape and meet the desired outcomes of the land use plan, which means returning the land to a condition approximate to or better than pre-disturbance conditions. Reclamation for this plan is defined as the rehabilitation of a disturbed area to make it acceptable for designated use that often requires regrading, replacement of topsoil, revegetation, and other measures. Reclamation objectives include initial stabilization goals and long-term reclamation measures to ensure biophysical conditions are maintained in the short term to achieve long-term goals of revegetation and ecosystem reconstruction.

1.1.1 Initial Stabilization

Initial (or temporary) stabilization is performed during construction. The goal of initial stabilization is to stabilize soils and control erosion until long-term reclamation techniques are implemented.

1.1.2 Preliminary Reclamation

Preliminary reclamation is typically initiated during construction or the drilling phase. This reclamation practice occurs during an extended drilling program with multiple wells over multiple years, and is determined on a site by site basis. The goal of preliminary reclamation is to enhance site stabilization, manage soil resources, and reduce the overall surface disturbance footprint.

1.1.3 Long-term Reclamation

Long-term reclamation refers to measures applied to stabilize disturbed areas, control runoff and erosion, and achieve reclamation goals and objectives concurrently with construction, maintenance and operation, or decommissioning of facilities. There are two phases of long-term reclamation.

- Interim reclamation is initiated on well pads, access roads, and temporary use areas after drilling activity is completed and all the planned wells are in production. The objective of interim reclamation is to maintain a healthy, biologically active topsoil; control erosion; and minimize habitat, visual, and forage loss on those portions of the disturbed area not needed for operations for the life of the Project or until final reclamation is initiated.
- Final reclamation is initiated following construction on pipelines and after the production phase at the end of the life of the well or facility. The objective of final reclamation is to return the land to a condition approximating that which existed prior

to disturbance, with allowances for an improved and/or stable ecological condition, if possible. This includes reconstruction of the landform to its original state along with re-establishment of a stable vegetative community, hydrologic systems, visual resources, agricultural values, and wildlife habitats.

1.2 RECLAMATION SUCCESS STANDARDS

Reclamation success standards will be used to assess whether the reclamation standards are being met. On disturbed lands not needed for future activities, final reclamation will be pursued immediately. Reclamation standards will be established to monitor landscape reconstruction, surface and soil stabilization, and revegetation success. Success standards on public lands will be determined in coordination with USFS staff. Successful reclamation is situational and inherently site-specific.

1.2.1 Surface and Soils Stabilization Standards

The land surface will be recontoured and other soil conservation, surface manipulation, and water management techniques will be implemented to establish stable slopes, watercourses, and drainage features to minimize erosion and sedimentation (also protecting surface water and groundwater resources). The soil surface must be stable and should have adequate surface roughness to reduce run-off and capture rainfall and snow melt. Additional short-term measures, such as the application of mulch or mechanical surface roughening, could be used to limit surface soil movement. Erosion control measures will be implemented in accordance with the approved APDs, EOG's Field Wide SWPPP, and EOG's Environmental Handbook for the Powder River Basin.

1.2.2 Revegetation Standards

Vegetation production and relative species diversity will approximate the composition and characteristics of the surrounding landscape. The vegetation will stabilize the site and support the planned post-disturbance land use, provide for natural plant community succession and development, be self-perpetuating, and noxious weeds will be controlled in accordance with the standards set forth herein. Revegetation will be deemed successful when the following criteria are met.

- A self-sustaining, diverse, and locally native plant community is established on the site. Seed mixtures will be developed based on site-specific characteristics following Natural Resources Conservation Service (NRCS) guidance. Vegetation will have a density sufficient to control erosion and non-native plant invasion and re-establish wildlife habitat and forage production.
- Resilient vegetation is established on the site. Plants must be resilient as evidenced by well-developed root systems and successful reproduction (vegetative and sexual).
- Invasive plant and noxious weed species are a minor component of the plant community on the site. Part of successful revegetation includes maintaining native plant communities with minimal weed occurrences.

1.2.3 Landscape Reconstruction Standards

Landscape reconstruction will be deemed successful when the original landform has been restored or approximated for disturbed areas that are not required for regular operations and maintenance activities. Erosion control measures will be implemented in accordance with EOG's Field Wide SWPPP and Environmental Handbook for the Powder River Basin.

1.2.4 Reclamation Success Monitoring

The operator will conduct routine monitoring during and following reclamation activities to determine if success standards have been met or if additional reclamation actions are required. Monitoring data and/or site assessments on private and state lands will be used to assess reclamation success and included in final bond release application. Success standards and monitoring requirements on public lands will be determined in coordination with USFS staff.

2.0 PRE-DISTURBANCE SITE CHARACTERIZATION

Pre-disturbance site characterization is a critical component for reclamation monitoring purposes to describe the surrounding landscape, determine ecological community types, and assess biophysical parameters during planning. Pre-disturbance planning provides data that allow for proper site characterization and timely implementation of activities, as well as the landscape, soil, and vegetation characteristics to be recreated with reclamation practices.

2.1 ECOLOGICAL SITE DESCRIPTIONS

An ecological site is a specific kind of land defined by its physical characteristic that differs from other communities within a landscape in its ability to produce and support a distinctive type and amount of vegetation, and in its ability to respond similarly to management actions and natural disturbances (Natural Resources Conservation Service [NRCS] 2003). NRCS soil surveys along with aerial imagery, climate, land management, and other natural factors will be used to describe ecological sites (Attachment A).

2.1.1 Pre-Disturbance Site Assessment

A remote desktop analysis will be conducted for disturbance areas to rapidly assess plant community characterizations, soil surface indicators, and general soil types to ensure that each identified ecological site is appropriately classified. Qualitative data on topography, vegetation, and soil will be gathered during field onsites as part of the application for permit to drill (APD) process and will supplement site characteristics, including ecological communities and other natural resources. Steep slopes (greater than 25 percent), aspect, and unique topographic features (i.e., rock outcrops, unique boulders, natural moss rock piles, etc.) will be identified.

2.2 SENSITIVE AREAS

Maintaining and restoring the biological, chemical, and physical characteristics is necessary to meet reclamation success standards and maintain healthy rangelands. During all surface-disturbing activities, topsoil would be identified and salvaged separately from spoil and stockpiled to support future reclamation efforts. Suitable topsoil typically has physical and chemical properties that promote rather than inhibit vegetation growth. Suitable topsoil

typically is a well-developed, non-shallow soil with neutral soil pH, low salt content, low to moderate elevated sodium adsorption ratio, and loamy texture. Sandy or clayey soils with very little biological activity, no topsoil or very shallow topsoil (less than 3 inches), high alkalinity and/or salinity, or elevated sodium adsorption ratio (greater than 13) should be avoided. Abiotic crusts, well-developed cryptobiotic crusts, and soils with high coarse fragment content should also be identified as poor topsoil conditions.

Sensitive areas include landscape features, soil attributes, and vegetation community characteristics that may limit the success of reclamation. Land attributes within the Project that are indicators of areas difficult to restore include sand dune ecosystems, saline and/or sodic soils, biological crusts, badlands, floodplains, wetlands, and rocky and steep terrain with little vegetation. Best Management Practices (BMPs) and other site-specific strategies will be developed during the APD stage to mitigate impacts and/or to increase reclamation success. BMPs will address the site-specific requirements of the Project and local environment.

3.0 SURFACE-DISTURBING ACTIVITIES

Components of surface-disturbing activities are described in the Project Plan of Development (PoD). Construction planning will provide a description of the extent of the Project area covered by the reclamation plan. Pre-disturbance assessments will provide the baseline information to assist construction planning.

3.1 CONSTRUCTION PLANNING

Upon final Project design, a Surface Use Plan of Operations (SUPO) will be completed to include a Project layout, location and detail of surface-disturbing activities, and design documentation. The final project design will be developed in coordination with the surface and mineral owners typically during the staking and onsite process. This information will be included in the APD and used to determine specific reclamation techniques and reclamation timing for different construction elements and locations. The SUPO will provide detailed descriptions of the Project components described in the following subsections.

3.1.1 Well Pads and Optimized Development Pads (ODPs)

The physical landscape of the project site will be analyzed via remote desktop and during the staking and onsite process. The location and orientation of the proposed project site will be evaluated to determine the optimal placement, taking into consideration the physical features and regulatory stipulations.

3.1.2 Access Roads

Immediately following road construction, stockpiled topsoil will be evenly redistributed over the road embankment and borrow ditch slopes. These areas will be stabilized and reclaimed with the approved seed mix as soon as practicable and prior to the next growing season.

3.1.3 Production Facilities

Production facilities will typically be situated on a portion of the ODP but in some circumstances a separate pad containing only production facilities will be utilized. The amount of production facilities may fluctuate over time, but some facilities will remain on the pad for the life of the well. Typically facility pads will be built to its needed operational size and interim reclamation can be performed right away. Reduction of the facilities pad size and further reclamation of the pad may occur if production capacity diminishes over time and fewer facilities are needed for continued operation.

3.1.4 Pipeline and Utility Corridors

Subsurface openings and underground workings associated with the development are described in the PoD. Underground workings for infrastructure such as pipelines, cathodic protection, and other infrastructure will be trenched and backfilled with the same excavated material or appropriately engineered backfill materials in a reverse method from which it was excavated. The typical construction techniques for the proposed pipeline construction are described in the PoD. In most cases the right-of-way (ROW) will be mowed or scalped of vegetation to provide a safe working environment, and to leave the integrity of the root system and soil profiles. Track hoes or trenchers excavate the pipeline trench to the required size. In cases where the topsoil is stripped along the ROW, it will be stored separately from the excavated subsoil. Drainages and other water body crossings will be evaluated at the time of Project planning and construction to determine appropriate subsurface BMPs to be implemented. Trench breakers made from sand bags or prefabricated concrete bags may be used at the outer extents of wetlands and drainage crossings to minimize the potential for any ‘French drain’ effect or inadvertent subsurface drainage of water bodies. Trench breakers may also be used to prevent ‘piping’ or lateral subsurface water movement along trenched pipelines in areas where pipelines parallel water bodies and stream courses. Backfilled material will be compacted to the applicable design standards and salvaged topsoil will be redistributed per predetermined depths.

<u>Stabilization</u>

Subsurface stabilization will include compaction of redistributed subsoils, installation of trench breakers, and managing surface storm water to Project design standards, as applicable.

<u>Water Quality</u>

Water quality will be maintained during surface-disturbing activities using BMPs and reclamation prescriptions predefined in the PoD, SWPPP, and in compliance with the Clean Water Act (CWA).

3.2 WASTE MATERIAL MANAGEMENT

All waste materials will be managed through the segregation, treatment, and/or bio-remediation of contaminated soil material; by burying only authorized waste materials on site; and ensuring that all waste materials moved off-site are transported to an authorized disposal facility.

3.2.1 Handling of Contaminated Soil Material

Contaminated soils can be defined as any soils subject to a foreign substance that modifies the chemical properties of soils to the extent that vegetation re-establishment is not achievable within a reasonable amount of time following Project implementation. All contaminated soils will be transported, managed, and disposed of according to procedures outlined in EOG's SWPPP and the Environmental Handbook for the Powder River Basin.

3.2.2 Disposal of Waste Materials

The construction contractor will keep all hazardous, non-hazardous, special, and general trash wastes separate and will not mix waste streams. Hazardous material will be managed and disposed of as predetermined by EOG's SWPPP and the Environmental Handbook for the Powder River Basin or through coordination with the appropriate governing regulatory agency.

4.0 SOIL MANAGEMENT

Soil is constantly being weathered through biological processes, which develops the structure and function essential in sustaining vegetation communities and providing wildlife habitat. Thus, maintaining soil structure and function is critical for successful reclamation efforts. During surface-disturbing activities, topsoil will be separated and handled differently than other soil layers, and topsoil will be salvaged during construction to use for site preparation and support future reclamation efforts. Components of soil management will include soil handling, landscape reconstruction, and surface runoff and erosion control. Soil management on public lands will be determined in coordination with the applicable agency's staff, either the USFS or the BLM.

4.1 SOIL HANDLING

A critical component of reclamation is maintaining the biological, chemical, and physical integrity of the soil resource by establishing a series of guidelines for the proper handling of topsoil and subsoil. For each surface-disturbing activity, topsoil, and in some instances subsoil, will be salvaged from surface disturbance activities and stockpiled. Proper salvaging techniques involve delineating soil type and determining soil depth.

During development of well sites and associated developments, topsoil will be separated and handled differently than other soil layers, and all topsoil will be salvaged during well construction to support future reclamation efforts. All suitable topsoil will be stripped to provide sufficient quantities to be respread to a minimum depth of 6 inches over the disturbed areas to be reclaimed. Soil removal will be avoided in areas where deep soils exist, such as floodplains and drainage channel terraces. EOG will provide additional information and BMPs in their SUPO and site-specific reclamation plan to minimize and mitigate impacts (Attachment B).

Stored soil material (i.e., stockpiles) will be incorporated into the disturbed landscape. During construction planning and salvage evaluation (i.e., topsoil depth and salvage will be predetermined from soil depth map and ecological sites), the amount of salvaged soil will be calculated and stockpile locations identified within the disturbance footprint. Preliminary evaluations during construction planning and surface disturbance geographic information

system (GIS) files should include identified stockpile locations for the SUPOs. Alternatively, stockpile locations within the disturbed area would be determined following site-specific salvage depth evaluations and topsoil volume calculations. Placement of stockpiles will be planned to minimize disturbance during interim and final reclamation. Topsoil stockpiles for linear features (e.g., roads, pipelines) would be stored adjacent to the disturbed area on native soil, re-spread once construction is completed, and then seeded with the approved seed mixture. Topsoil piles to be stored over a growing season will be seeded with an approved seed mixture. EOG will provide additional information and BMPs in their SUPO and site-specific reclamation plan to minimize and mitigate impacts (Attachment B).

4.2 LANDSCAPE RECONSTRUCTION AND EROSION CONTROL

Surface runoff and erosion control in areas exposed to surface-disturbing activities will be accomplished by reconstructing the landscape and maintaining soil stability. The landscape will be reconstructed to achieve a desired topography, slope stability, and surface stability. Site stability will be reestablished following landscape reconstruction to the approximate original contour by maximizing the geomorphic stability and topographic diversity of the reclaimed landscape. Reestablishing the complementary visual character of a disturbed area would ensure that the reclaimed area does not result in a long-term change to the scenic quality of the overall landscape. This includes recontouring the disturbed area to be consistent with the land use plan and to provide a natural landscape capable of supporting wildlife habitat and a viable and diverse population of native plants. In most cases, dozers, loaders, scrapers, and motor graders are typically used for backfilling and grading. EOG will provide additional information and BMPs in their SUPO and site-specific reclamation plan to minimize and mitigate impacts (Attachment B).

4.3 SOIL STABILIZATION AND EROSION PROTECTION

Erosion control measures will be implemented to avoid, minimize, or mitigate impacts from surface-disturbing activities and restore the landscape back to a natural state. Erosion control measures will be installed prior to and immediately following surface-disturbing activities. Initial stabilization measures will be used to control surface runoff and erosion and to ensure biophysical conditions are maintained until long-term reclamation can be initiated. Long-term erosion control measures will be established at two stages of reclamation—interim reclamation and final reclamation—with an overriding goal of revegetation and ecosystem reconstruction.

Immediately following surface-disturbing activities, temporary runoff and erosion control measures will be implemented where necessary to ensure soil stabilization. Applications include mulching and netting of biodegradable blankets stapled firmly to the soil surface; applying sediment control; respreading scalped vegetation; and constructing water bars, diversion ditches, sediment fences, and energy dissipaters. Road ROWs require stabilization on both sides of drainage channels and would be determined on site-specific evaluations. Following construction and soil stabilization, long-term measures will be applied to further stabilize disturbed areas and control surface runoff and erosion to meet reclamation standards. EOG will provide additional information and BMPs in their SUPO and site-specific reclamation plan to minimize and mitigate impacts (Attachment B).

4.4 SITE PREPARATION

Site preparation restores the area back to the original landscape by recreating the physical characteristics that approximate the visual quality of adjacent areas with regard to form, line, color, and texture of major landscape features. Components of site preparation include landscape reconstruction and preparing the site for revegetation. Appropriate erosion control devices will be installed on reclaimed areas prior to topsoil replacement, as necessary. Compacted areas will be treated with the most appropriate methods and technologies to improve soil aeration, water infiltration, and root penetration. Compaction will be reduced to below the root zone (i.e., 18–24 inches below the surface) prior to topsoil redistribution to promote the establishment of desired plant species. Seedbed preparation maximizes seeding efficiency and improves reclamation success. It includes topsoil replacement (with amendments, where appropriate) and discing. Surface roughening procedures (e.g., ripping, pitting, gouging) may be applied.

4.5 SOIL MATERIALS

The long-term establishment and viability of the desired plant community is dependent upon providing adequate surface and subsurface properties. The addition of soil amendments may be necessary to ameliorate poor topsoil quality, due to shallow soils and/or the use of spoil during seedbed preparation. EOG will provide additional information and BMPs in their SUPO and site-specific reclamation plan to minimize and mitigate impacts (Attachment B).

Soil materials will be redistributed in a manner to preserve the chemical, physical, and biological properties similar to the original soil profile. Topsoil is typically replaced using scrapers, dozers, and/or motorgraders. If multiple topsoils are stockpiled, stockpiles will be marked with stakes and flagging and the correct topsoil will be redistributed to the appropriate depth according to ecological site. If the stockpile for a given location contains insufficient topsoil for redistribution, topsoil may be mixed with suitable spoil or imported from another stockpile with similar properties (i.e., same ecological site).

After topsoil replacement, compacted soils will be disced or harrowed to reduce soil compaction, break up soil clods, improve root and water penetration, and provide a friable but firm seedbed. Discing and harrowing are typically accomplished using a tractor-drawn disc or harrow. The surface will be roughened to reduce wind and water erosion and promote moisture capture. If the surface is roughened during discing, other moisture-capture techniques will not be necessary

Mulching would be necessary in reclaimed areas where surface roughening is not adequately reducing wind and water erosion or promoting moisture capture. Mulch incorporates organic matter and protects the soil surface from wind and water erosion and raindrop impact, while also providing a sufficient seedbed to hold seeds in place and protect seedlings. Reclaimed areas will be uniformly mulched with certified weed-free native grass, hay, small grain straw, wood straw, and/or live mulch at a rate sufficient to maintain appropriate cover.

5.0 REVEGETATION

The primary objective of revegetation is to establish the species composition, diversity, structure, and total ground cover appropriate for the desired plant community. Appropriate measures will be taken to ensure that the soil surface is adequately protected. Proper seeding mixtures will be used to reclaim disturbed areas on public lands with native vegetation. The seed mixture selection process for public lands would consider NRCS pick lists, seed availability and price, growth form, seasonal variety, and prevailing dominant species. To increase the likelihood of successful reclamation, locally adapted native plant materials based on the site characteristics and ecological setting (i.e., the pre-disturbance site characterization) would be selected when possible. The composition of rare and native species, if encountered, would be considered at the time of seeding; however, reclaimed areas not exhibiting successful revegetation within the first few growing seasons would be re-seeded until an adequate cover of vegetation is established. EOG will provide additional information and BMPs in their SUPO and site-specific reclamation plan to increase the success of vegetation reestablishment (Attachment B).

5.1 SEED MIXTURE DESIGN

Proper seeding mixtures will be used to reclaim areas with native vegetation. Seed mixtures will be tailored to establish species diversity and composition appropriate for each desired plant community for each ecological site (Attachment C), and in accordance with the preferences of the private surface landowner. The seed mixture selection process will consider seed availability and price, growth form, seasonal variety, and prevailing dominant species. Seed mixtures will be based on the phase of reclamation. Initial stabilization seed mixtures will include native or non-native mixtures that rapidly establish and protect topsoil. Interim reclamation will include herbaceous species and predominantly cool and warm season native grass species. Final reclamation seed mixtures will include native species that are reflective of current ecological site conditions or support current land uses. Seed mixtures used on public lands would be approved by USFS staff. The seed mixture would contain the following.

- Native dominant herbaceous species that support the post-disturbance land uses.
- Additional species native to the region that support the post-disturbance land uses, if needed.
- Naturalized, introduced species only if additional herbaceous species are needed, if suitable native species are unavailable, or if naturalized species are superior for a specialized land use (e.g., managed hay land or pastureland).
- Native forb species or other landowner-approved plant species, where appropriate.

Reclaimed areas would be seeded using species selected from ecological site-specific pick lists presented in Attachment C of this document. These species pick lists were developed based on the following criteria: ecological site membership, general conditions within the analysis area, species adaptations to site conditions, usefulness of the species for rapid site stabilization,

species success in past revegetation efforts, seed costs and availability, and compliance with Executive Order 13112.

5.2 SEEDING

Seeding will be implemented during all phases of development depending on initial or long-term reclamation objectives. Initial seeding will be used to achieve temporary vegetation coverage or stabilization for soil stockpiles, or until interim or final reclamation measures can be conducted. Seeding for interim reclamation will occur following completion of all drilling activities on well pads and construction of access roads. Final reclamation activities will be initiated after the production phase of the wells, as well as following the installation of underground pipelines and utilities. Final reclamation measures will include seeding following the redistribution of soils to the original vertical profiles, compaction evaluations, mulching and amendment additions, soil roughening with other BMPs, and other reclamation measures identified in the PoD and Project SWPPP for a particular area. EOG will provide additional information and BMPs in their SUPO and site-specific reclamation plan to increase the success of vegetation reestablishment (Attachment B).

In general, the timing of seeding will follow final earthwork and grading associated with each phase of development and during the reclamation phases. Temporary coverage seeding will take place immediately following initial disturbances to stabilize soils. Permanent seeding measures will take place within the most optimal times of seeding. Seeding timing will consider elevation, annual rainfall, reclamation and storm water management needs, and land use management objectives.

There are a variety of techniques and methods for the application of seed depending on specific site conditions and objectives. Drill seeding or other similar planting methods will be primarily used where the terrain is accessible by equipment and cost effective. Shrub seeding will be conducted separately from herbaceous species seeding along separate drill rows to minimize competition from faster growing herbaceous species. In some areas, cross drill seeding or overlapping patterns may be used to mimic more natural areas or further protect a particular site from erosion forces.

Broadcast seeding will be used when drill techniques are not feasible due to slopes, substrate, access, and cost effectiveness. Broadcast seeding will occur on a roughened seedbed and then will be lightly harrowed, chained, or raked to cover the seed. The seeding rate for broadcast seeding will be a minimum of double the recommended rate of the mixtures developed for drill seeding. EOG will provide additional information and BMPs in their SUPO and site-specific reclamation plan to increase the success of vegetation reestablishment (Attachment B).

6.0 WEED MANAGEMENT

Weed management in the Project Area is a cooperative effort between EOG, the surface landowner, and the Wyoming Weed and Pest Council. Noxious weeds, and their occurrence in the Project area and surrounding counties, are detailed in Appendix D. The presence, distribution, and density of noxious/invasive weeds that occur in the development infrastructure will be monitored by EOG. The well access roads, well pads, staging areas, and other Project-

related soil disturbances will be inspected regularly to ensure that noxious and/or invasive weeds do not become established on newly disturbed sites. A weed control plan will be developed and will accompany the SUPOs (Attachment D). It will include the following elements:

- Coordination with Campbell County Weed and Pest, Converse County Weed and Pest, and surface landowners to determine priorities for weed management.
- Methods for controlling existing populations and minimizing the spread of invasive plants, such as
    - minimization of surface disturbance when possible to reduce the potential area for noxious and invasive weed establishment;
    - an integrated pest management approach for controlling invasive plants.
- Techniques for monitoring invasive plant occurrences and treatments.

The weed control plan will be employed on APDs approved on the Project to assist in the control of noxious and invasive weed species and to facilitate the reclamation of disturbed areas.

7.0 GREATER SAGE-GROUSE HABITAT

At present, the Wyoming Sage-grouse Land Use Plan Amendment is in draft form, and the reclamation framework for surface disturbance in greater sage-grouse habitat has not been approved or adopted by BLM or USFS. Site-specific reclamation plans for APDs submitted under the Greater Crossbow EIS will incorporate applicable and appropriate reclamation strategies and standards from the Draft Wyoming Sage-grouse Land Us Plan Amendment (BLM 2014b).

8.0 MONITORING AND REPORTING

Site monitoring is conducted to observe and keep track of environmental conditions of the reclaimed site and to document proper development of the reseeded plant community, soil stability, and proper ecosystem function. Continued characterization after disturbance and during interim reclamation is appropriate for monitoring site maturation and stability. Site monitoring and reporting on public lands will be in coordination with USFS.

Noxious weed surveys will be conducted to evaluate the presence and aerial extent of noxious and invasive weed species occurrences on lands disturbed by Project activities. Preventative management measures will be applied as warranted pursuant to the weed control plan.

EOG will conduct monitoring following reclamation to ensure the success of reclamation and erosion control methods. Additional monitoring will be conducted compliant to SWPPP. SWPPP monitoring will quickly identify needed corrective actions and reduce the potential for soil loss or contamination of water resources through sedimentation.

8.1 IDENTIFY ADDITIONAL RECLAMATION

Monitoring reclamation success on private lands and state lands will be coordinated with private landowners, the Wyoming State Land Board, or WGFD as appropriate to meet specific land

use standards. On public lands, the USFS, BLM, or Wyoming State Trust Board will provide a determination as to whether or not reclamation assessments are accurate and success standards are being met. If necessary, the USFS would provide input on remedial actions to facilitate reclamation success. Administrative BMPs may include reseeding non-attainment areas, soil stabilization and amendments, weed control, and mulching.

9.0 REFERENCES

Bureau of Land Management (BLM) 2007. Record of Decision and Approved Casper Resource Management Plan. Wyoming State Office – Casper Field Office. December.

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Attachment A

Ecological Site Key and Descriptions

The Northern Rolling High Plains, Southern Part, Major Land Resource Area (MLRA) 58B includes approximately 19,265 square miles, with the majority in Wyoming, and the remaining land in Montana (USDA, NRCS 2006). The area generally consists of old plateaus and terraces that have been deeply eroded. Elevation ranges from ranges from 2,950 to 5,900 feet and increases gradually from north to south. The North Platte River runs through the southern part of this MLRA and the upper reaches of the Powder, Tongue, Belle Fourche, and Cheyenne Rivers drain the northern half of the area (USDA, NRCS 2006). The middle third of this area is underlain by Tertiary continental sediments with shale, siltstone, and sandstone being the dominant rock types. Cretaceous marine and continental sediments underlie the northwestern third and southeastern third of the area. These older units consist of interbedded layers of shale, siltstone, and sandstone (USDA, NRCS 2006). The surface water is generally of good quality, but supplies away from the North Platte, Powder, and Tongue Rivers are scarce. Ground water from the Structural Basin aquifer underling almost all of this area is saline and unsuitable for drinking with median concentration of total dissolved solids at 1,100 parts per million (USDA, NRCS 2006). The dominant soil orders in this MLRA are Aridisols and Entisols (USDA, NRCS 2006). They are shallow to very deep, generally well drained, and loamy or clayey. The average annual precipitation ranges from 9 to 27 inches and average annual temperature ranges from 41 to 48 degrees Fahrenheit, with the frost-free period averaging 145 days.

This area supports grassland vegetation (USDA, NRCS 2006). Rhizomatous wheatgrasses (e.g. *Pascopyrum smithii*), green needlegrass (*Nassella viridula*), needleandthread (*Hesperostipa comata*), and blue grama (*Bouteloua gracilis*) are the dominant species on deeper soils. Rhizomatous wheatgrasses, bluebunch wheatgrass (*Pseudoroegneria spicata*), Indian ricegrass (*Achnatherum hymenoides*), and needleandthread are the major species on shallow soils on hills and ridges. Basin wildrye (*Leymus cinereus*), green needlegrass, rhizomatous wheatgrasses, and shrubs are dominant at lower elevations and along streams. Big sagebrush (*Artemisia tridentata*) is the dominant shrub within this MLRA. Dominant land uses in this MLRA includes cropland, grassland, forest, and urban development with about three-fourths of this area being privately owned. Public lands are mostly used for recreation and livestock grazing, while private lands are mostly grassland areas used for grazing, developed as cropland or urban areas.

Table A-1. Ecological sites found within MLRA 58B – Northern Rolling High Plains, Southern Part

Ecological site	Range site number	Site characteristic	Acres within EIS area
Saline Upland	R058BY144WY	Saline	834.67
Lowland	R058BY128WY	Mesic	3943.01
Clayey Overflow	R058BY106WY	Mesic	340.66
Shallow Clayey	R058BY158WY	Xeric	1113.34
Shallow Loamy	R058BY162BY	Xeric	12965.50
Shallow Sandy	R058BY166WY	Xeric	2025.14
Sandy	R058BY150WY	Xeric	35011.86
Clayey	R058BY104WY	Xeric	13554.27
Loamy	R058BY122WY	Xeric	49572.38
Sands	R058BY146WY	Xeric	257.11

KEY TO ECOLOGICAL SITES

MLRA 058B – Northern Rolling High Plains, Southern Part
ZONE 14 – 10-14" Northern Plains (10-14" NP)

A. Saline site that has saline or saline-sodic conditions within surface 20" (*electrical conductivity greater than 4.0 mmhos/cm*) or soils contain natric horizons

1. Loam to sandy loam surface textured soils over a clayey subsurface; coarse fragments are not typical; Gardner's saltbush and winterfat dominant woody species; greasewood and woody aster will dominate as site deteriorates **Saline Upland (SU) – R058BY144WY**

B. Mesic site that receives additional effective moisture from surrounding environment

2(a). Site is located in a lowland position, adjacent to a stream, and frequently flooded; soils are loamy, generally poorly drained, and cobbles are typically present; rhizomatous wheatgrasses, green needlegrass, and cottonwoods are dominant species; wild rose, snowberry, and silver sagebrush increase as site deteriorates **Lowland (LL) – R058BY128WY**

2(b). Site is transitioning from lowland to upland position; soils are clay loams to sandy clay loams with no rock fragments; basin wildrye and rhizomatous wheatgrasses are dominant grass species; blue grama and big sagebrush will dominate as site deteriorates **Clayey Overflow (CyO) – R058BY106WY**

C. Xeric site that does not receive additional effective moisture from surrounding environment

3(a). Soil depth is very shallow (<10 inches) or shallow (10–20 inches) due to root-restrictive layer (*LOW productivity potential*)

4(a). Bedrock material is predominantly clay shale, soils are fine-textured and rarely sandy, and have rock fragments; western wheatgrass and green needlegrass are dominant grass species; birdfoot sage is typically present **Shallow Clayey (SwCy) – R058BY158WY**

4(b). Bedrock material may vary but predominantly sandstone; birdfoot sage is not present

5(a). Subsurface soils are predominantly loams; needleandthread and blue grama are dominant grass species; big sagebrush will increase and blue grama will become sod-like as site deteriorates; threadleaf sedge is not present **Shallow Loamy (SwLy) – R058BY162BY**

5(b). Surface soils will have coarse modifier and subsurface soils are always coarse-textured sands; needleandthread and prairie sandreed are dominant grass species; threadleaf sedge and fringed sage are present and will dominate as site deteriorates **Shallow Sandy (SwSy) – R058BY166WY**

3(b). Soil depth is moderately deep to deep (>20 inches) without root-restrictive layer that inhibits the productivity potential

6(a). Site is located on alluvial fans and plateaus, including ridges leading to these features; soils are non-skeletal and subsurface textures are always coarse-textured sands; needleandthread and prairie sandreed are dominant grass species; threadleaf sedge, fringed sage, and silver sagebrush will increase as site deteriorates

Sandy (Sy) – R058BY150WY

6(b). Subsurface textures are not sands

7(a). Site is located on alluvial fans and stream terraces, including adjacent hillslopes; surface textures have noticeable clay component and subsurface textures are strictly clay (columnar in structure);soils typically have slow permeability and cobbles are present; western wheatgrass and green needlegrass

are dominant grass species; blue grama, plains pricklypear, and big sagebrush will increase as site deteriorates **Clayey (Cy) – R058BY104WY**

7(b). Subsurface textures are not clays

8(a). Site located on hillslopes, alluvial fans, and ridges; surface textures are loams; rhizomatous wheatgrass and blue grama are dominant grass species; blue grama will become sod-like and big sagebrush will increase as site deteriorates **Loamy (Ly) – R058BY122WY**

8(b). Site predominantly located on ridges and shoulders; surface textures are sands and subsurface textures are loams; sites tend to be dunal with eolian deposits; needleandthread and prairie sandreed are dominant species; threadleaf sedge, sand dropseed, and silver sagebrush will increase as site deteriorates **Sands (Sa) – R058BY146WY**

DESCRIPTIONS OF ECOLOGICAL SITES (NRCS 2011)

Clayey 10-14" Northern Plains Precipitation Zone

The Clayey 10-14" Northern Plains Precipitation Zone ecological site is an area described for its specific physical characteristics, which differs from other kinds of land in its distinctive plant community and responses to land management practices (NRCS 2000a). Distinctive physiographic features include hills, alluvial fans, and stream terraces. The soils in this area consist of alluvium or alluvium over residuum, generally greater than 20 inches in depth. This ecological site includes six major plant communities: rhizomatous wheatgrass/green needlegrass (historic climax plant community); heavy sagebrush; greasewood/rhizomatous wheatgrass; mixed sagebrush/grass; blue grama sod; and, fallow agricultural communities. The dominant species of the historic climax plant community include western wheatgrass (*Pascopyrum smithii*), and green needlegrass (*Nassella viridula*), and the community generally consists of approximately 75 percent (canopy cover) perennial grasses, 15 percent forbs, and 10 percent woody plants. Other common grasses generally include Cusick bluegrass (*Poa cusickii*), Sandberg bluegrass (*Poa secunda*), needleleaf sedge (*Carex duriuscula*), blue grama (*Bouteloua gracilis*), and plains reedgrass (*Calamagrostis montanensis*). If ecological condition deteriorates due to over grazing, cool-season grasses such as green needlegrass, needleandthread (*Hesperostipa comata*), and western wheatgrass will decrease, while blue grama, plains pricklypear (*Opuntia polyacantha*), cheatgrass (*Bromus tectorum*), and big sagebrush (*Artemisia tridentata*) will increase to dominate the site. Historically, natural fires were frequent in this community and prevented big sagebrush from being the dominant landscape. Protection from grazing and fire will convert this plant community to the heavy sagebrush vegetation community. Cheatgrass, Russian thistle (*Salsola kali*), and other annuals are the most likely exotic species to invade this site.

Clayey Overflow 10-14" Northern Plains Precipitation Zone

The Clayey Overflow 10-14" Northern Plains Precipitation Zone ecological site is an area described for its specific physical characteristics, which differs from other kinds of land in its distinctive plant community and responses to land management practices (NRCS 200b). Distinctive physiographic features include alluvial fans, and stream terraces. The soils in this area consist of alluvium or alluvium over residuum, generally greater than 20 inches in depth. This ecological site includes three major plant communities: rhizomatous wheatgrass/basin wildrye (historic climax plant community); western wheatgrass/green needlegrass; and mixed sagebrush/grass communities. The dominant species of the historic climax plant community include basin wildrye (*Leymus cinereus*), rhizomatous wheatgrasses (e.g. western wheatgrass), and green needlegrass, and the community generally consists of approximately 85 percent (canopy cover) perennial grasses, and 15 percent forbs. Other common grasses generally include Cusick bluegrass (*Poa cusickii*), Sandberg bluegrass (*Poa secunda*), needleleaf sedge (*Carex duriuscula*), Canada wildrye (*Elymus canadensis*) and prairie junegrass (*Koeleria macrantha*). If ecological condition deteriorates due to over grazing, cool-season grasses such as basin wildrye, green needlegrass and rhizomatous wheatgrasses will decrease, while blue grama and big sagebrush will increase to dominate the site. Historically, natural fires were frequent in this community and prevented big sagebrush from being the dominant landscape. Protection from grazing and fire will convert this plant community to the mixed sagebrush/grass vegetation community. Cheatgrass, Russian thistle, and other annuals are the most likely exotic species to invade this site.

Loamy 10-14" Northern Plains Precipitation Zone

Loamy 10-14" Northern Plains Precipitation Zone ecological site is an area described for its specific physical characteristics, which differs from other kinds of land in its distinctive plant community and responses to land

management practices (NRCS 2000c). Distinctive physiographic features include hills, alluvial fans, and ridges. The soils in this area are well drained & moderately permeable, generally greater than 20 inches in depth. This ecological site includes eight major plant communities: rhizomatous wheatgrass/needleandthread/blue grama (historic climax plant community); mixed sagebrush/grass; western wheatgrass/cheatgrass; blue grama sod; greasewood; heavy sagebrush; blue grama/plains pricklypear/bare ground; and fallow agricultural communities. The dominant species of the historic climax plant community include western wheatgrass, needleandthread, and green needlegrass, and the community generally consists of approximately 75 percent (canopy cover) perennial grasses, 15 percent forbs, and 10 percent woody plants. Other common grasses generally include Cusick bluegrass, Sandberg bluegrass, bluebunch wheatgrass (*Pseudoroegneria spicata*) and blue grama. If ecological condition deteriorates due to a combination of frequent and severe grazing, cool-season grasses such as green needlegrass, needleandthread, and rhizomatous wheatgrasses will decrease, while blue grama and big sagebrush will increase to dominate the site. Historically, low frequency fires and grazing bison were common in this community and prevented mixed sagebrush/grass from being the dominant landscape. Protection from use and fire for 20 plus years will convert this plant community to the heavy sagebrush plant community. Cheatgrass, Canada thistle, Dalmatian toadflax, leafy spurge and other annuals are the most likely exotic species to invade this site.

Lowland 10-14" Northern Plains Precipitation Zone

Lowland 10-14" Northern Plains Precipitation Zone ecological site is an area described for its specific physical characteristics, which differs from other kinds of land in its distinctive plant community and responses to land management practices (NRCS 2002a). Distinctive physiographic features include alluvial fans, drainageways and stream terraces. The soils in this area consist of mixed alluvium and are generally deep to very deep in depth. This ecological site includes four major plant communities: rhizomatous wheatgrass/green needlegrass/cottonwoods (historic climax plant community); mature cottonwoods/cool-season grasses; mature cottonwoods/cheatgrass; and, rhizomatous wheatgrass communities. The dominant species of the historic climax plant community include rhizomatous wheatgrasses, needleandthread, green needlegrass, and slender wheatgrass (*Elymus trachycaulus*), and the community generally consists of approximately 80 percent (canopy cover) perennial grasses, 10 percent forbs and 10 percent woody plants. Other common grasses generally include Sandberg bluegrass, Canada wildrye and prairie junegrass. If ecological condition deteriorates due to over grazing, cool-season grasses such as green needlegrass and rhizomatous wheatgrasses will decrease, while species such as wild rose, snowberry, and silver sagebrush will increase to dominate the site. Historically, natural floods were frequent in this community and prevented mature cottonwoods/cool-season grasses from being the dominant landscape. Protection from excessive grazing and flooding will convert this plant community to the mature cottonwoods/cool-season grass vegetation community. American licorice, Canada thistle, leafy spurge and other annuals are the most likely exotic species to invade this site.

Saline Upland 10-14" Northern Plains Precipitation Zone

Saline Upland 10-14" Northern Plains Precipitation Zone ecological site is an area described for its specific physical characteristics, which differs from other kinds of land in its distinctive plant community and responses to land management practices (NRCS 2001). Distinctive physiographic features include hills, alluvial fans, and stream terraces. The soils in this area consist of alluvium from sodic or alkaline materials, generally greater than 20 inches in depth. This ecological site includes two major plant communities: gardeners saltbush/winterfat (historic climax plant community); and, greasewood/woody aster communities. The dominant species of the historic climax plant community include Gardner's saltbush (*Atriplex gardneri*), winterfat (*Krascheninnikovia lanata*), alkali sacaton (*Sporobolus airoides*), rhizomatous wheatgrasses (e.g. western wheatgrass), inland

saltgrass (*Distichlis spicata*) and Indian ricegrass (*Achnatherum hymenoides*), and the community generally consists of approximately 45 percent (canopy cover) perennial grasses, 5 percent forbs and 50 percent woody plants. Other common grasses generally include squirreltail (*Elymus elymoides*) and Sandberg bluegrass. If ecological condition deteriorates due to over grazing, cool-season grasses such as Indian ricegrass, alkali sacaton and western wheatgrass will decrease, while species such as greasewood and woody aster will increase to dominate the site. Historically, large grazing animals were frequent in this community and prevented the historical climax plant community from being the dominant landscape. Protection from excessive grazing and instead allocating infrequent prescribed grazing will help convert this plant community back to the Historic Climax Plant Community Vegetation state. Cheatgrass and other annuals are the most likely exotic species to invade this site.

Sands 10-14" Northern Plains Precipitation Zone

Sands 10-14" Northern Plains Precipitation Zone ecological site is an area described for its specific physical characteristics, which differs from other kinds of land in its distinctive plant community and responses to land management practices (NRCS 2002b). Distinctive physiographic features include hills and ridges. The soils in this area consist of eolian deposits or alluvium, generally greater than 20 inches in depth. This ecological site includes three major plant communities: needleandthread/prairie sandreed (historic climax plant community); needleandthread/threadleaf sedge/yucca; and blowout/yucca/sandbur western ragweed communities. The dominant species of the historic climax plant community include needleandthread, prairie sandreed (*Calamovilfa longifolia*), sand bluestem (*Andropogon hallii*), and Indian ricegrass, and the community generally consists of approximately 85 percent (canopy cover) perennial grasses, 10 percent forbs and 5 percent woody plants. Other common grasses generally include Sandberg bluegrass, sand dropseed (*Sporobolus cryptandrus*), and threadleaf sedge (*Carex filifolia*). If ecological condition deteriorates due to over grazing, mid grasses such as prairie sandreed and Indian ricegrass will decrease, while threadleaf sedge, sand dropseed and silver sagebrush (*Artemisia cana ssp. cana*) will increase to dominate the site. Historically, large herbivores shaped this community through moderate/continuous grazing and prevented the historic climax plant community from being the dominant landscape. Protection from frequent and severe grazing will convert this plant community to the needleandthread/threadleaf sedge/yucca community.

Sandy 10-14" Northern Plains Precipitation Zone

Sandy 10-14" Northern Plains Precipitation Zone ecological site is an area described for its specific physical characteristics, which differs from other kinds of land in its distinctive plant community and responses to land management practices (NRCS 2002c). Distinctive physiographic features include alluvial fans, plateaus and ridges. The soils in this area consist of alluvium or alluvium over residuum, generally greater than 20 inches in depth. This ecological site includes three major plant communities: needleandthread/prairie sandreed (historic climax plant community); needleandthread/threadleaf sedge/fringed sage; and threadleaf sedge/fringed sagewort/plains pricklypear communities. The dominant species of the historic climax plant community include needleandthread, prairie sandreed, little bluestem (*Schizachyrium scoparium*), and Indian ricegrass, and the community generally consists of approximately 75 percent (canopy cover) perennial grasses, 15 percent forbs and 10 percent woody plants. Other common grasses generally include rhizomatous wheatgrasses, Sandberg bluegrass, blue grama, and threadleaf sedge. If ecological condition deteriorates due to over grazing, mid grasses such as prairie sandreed and Indian ricegrass will decrease, while species such as threadleaf sedge, needleandthread, fringed sagewort (*Artemisia frigida*) and silver sagebrush will increase to dominate the site. Historically, moderate to severe levels of grazing were frequent in this community and prevented the historic climax plant community from being the dominant landscape. Protection from frequent and severe grazing will convert this plant community to the needleandthread/threadleaf sedge/fringed sage community.

Shallow Clayey 10-14" Northern Plains Precipitation Zone

Shallow Clayey 10-14" Northern Plains Precipitation Zone ecological site is an area described for its specific physical characteristics, which differs from other kinds of land in its distinctive plant community and responses to land management practices (NRCS 2002d). Distinctive physiographic features include hills, ridges and escarpments. The soils in this area consist of alluvium or residuum, generally less than 20 inches in depth. This ecological site includes four major plant communities: rhizomatous wheatgrass/green needlegrass (historic climax plant community); mixed sagebrush/grass; big sagebrush/birdfoot sage/cheatgrass; and, heavy sagebrush communities. The dominant species of the historic climax plant community include rhizomatous wheatgrasses, green needlegrass, and bluebunch wheatgrass and the community generally consists of approximately 80 percent (canopy cover) perennial grasses, 10 percent forbs and 10 percent woody plants. Other common grasses generally include Cusick bluegrass, Sandberg bluegrass, needleleaf sedge, blue grama, and plains reedgrass. If ecological condition deteriorates due to over grazing, cool-season grasses such as green needlegrass, bluebunch wheatgrass, and rhizomatous wheatgrasses will decrease, while blue grama and big sagebrush will increase to dominate the site. Historically, natural fires occurred frequently in this community and prevented sagebrush from being the dominant landscape. Protection from grazing and fire will convert this plant community to the heavy sagebrush plant community. Cheatgrass and other annuals are the most likely exotic species to invade this site.

Shallow Loamy 10-14" Northern Plains Precipitation Zone

Shallow Loamy 10-14" Northern Plains Precipitation Zone ecological site is an area described for its specific physical characteristics, which differs from other kinds of land in its distinctive plant community and responses to land management practices (NRCS 2002e). Distinctive physiographic features include hills, ridges and escarpments. The soils in this area consist of alluvium over residuum or residuum, generally less than 20 inches in depth. This ecological site includes four major plant communities: rhizomatous wheatgrass/needleandthread/blue grama (historic climax plant community); mixed sagebrush/grass; blue grama sod; and, heavy sagebrush communities. The dominant species of the historic climax plant community include western wheatgrass, bluebunch wheatgrass, needleandthread, and little bluestem, and the community generally consists of approximately 75 percent (canopy cover) perennial grasses, 15 percent forbs and 10 percent woody plants. Other common grasses generally include Cusick bluegrass, Sandberg bluegrass, blue grama and prairie junegrass. If ecological condition deteriorates due to over grazing, cool-season grasses such as bluebunch wheatgrass and rhizomatous wheatgrasses will decrease, while blue grama and big sagebrush will increase to dominate the site. Historically, natural fires were frequent in this community and prevented big sagebrush from being the dominant landscape. Protection from grazing and fire will convert this plant community to the heavy sagebrush vegetation community. Cheatgrass and other annuals are the most likely exotic species to invade this site.

Shallow Sandy 10-14" Northern Plains Precipitation Zone

Shallow Sandy 10-14" Northern Plains Precipitation Zone ecological site is an area described for its specific physical characteristics, which differs from other kinds of land in its distinctive plant community and responses to land management practices (NRCS 2002f). Distinctive physiographic features include hills, ridges, and escarpments. The soils in this area consist of eolian deposits or alluvium over residuum or residuum, generally less than 20 inches in depth. This ecological site includes three major plant communities: needleandthread/prairie sandreed (historic climax plant community); needleandthread/threadleaf sedge/broom snakeweed; threadleaf sedge/fringed sagewort/yucca communities. The dominant species of the historic climax plant community include needleandthread, prairie sandreed, little bluestem, and sideoats grama (*Bouteloua curtipendula*), and the community generally consists of approximately 75 percent (canopy cover) perennial grasses, 15 percent forbs and

10 percent woody plants. Other common grasses generally include bluebunch wheatgrass, Sandberg bluegrass, blue grama and threadleaf sedge. If ecological condition deteriorates due to over grazing, mid grasses such as prairie sandreed and little bluestem will decrease, while species such as threadleaf sedge and fringed sagewort will increase to dominate the site. Historically, large herbivores were frequent in this community and prevented needleandthread/threadleaf sedge/broom snakeweed from being the dominant landscape. Protection from frequent and severe grazing will convert this plant community to the needleandthread/threadleaf sedge/broom snakeweed vegetation community. Broom snakeweed and other annuals are the most likely exotic species to invade this site.

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Attachment B – Best Management Practices[1]

[1] On private lands, implementation of any of the BMPs included in this attachment is dependent upon receiving consent from the private surface land owner.

Pre-Disturbance Site Characterization

Sensitive Areas

- During selection of drill site, road, pipeline, and ancillary facility locations, the Operators will attempt to avoid LRP and sensitive areas, including the following, unless otherwise authorized by the BLM AO:
    - areas with high erosion potential (e.g., rugged topography, steep slopes [>25%], drainage channels, floodplains);
    - areas with saturated soils;
    - areas within 500 feet of wetland or riparian areas (e.g., open water areas); and
    - areas within 100 feet of ephemeral and intermittent channels.
- The Operators will also consider BMPs during pre-disturbance planning and site preparation. The following documents will be consulted for BMP guidance:
    - The Oil and Gas Gold Book Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, Fourth Edition (USDOI and USDA 2007).
    - WGFD's Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats, Version 5.0, Revised March 2010.

Soil Management – Maintain Biological, Chemical, and Physical Integrity

Soil Salvage

- Topsoil will be salvaged from all proposed disturbance areas and stockpiled. Vegetation will be salvaged and stockpiled with topsoil to incorporate native seeds and organic matter.
- At each location to be disturbed, the Operators will use the soils map and soil salvage depths table to determine appropriate surface soil material salvage depths.
- Prior to all surface-disturbing activities, topsoil potential will be evaluated and salvage depth determined during pre-construction site characterization.
    - Additional soil physical and chemical characteristics will be evaluated during ecological site delineations.
    - If the ecological site and soil salvage depth cannot be identified from the pre-construction site characterization, additional soil pits and rapid soil tests will be necessary to evaluate site-specific topsoil conditions.
- Salvage depth diagrams developed from pre-construction site characteristics will be used to determine the appropriate surface soil material salvage depth.
- For excavations where the soil horizons are too rocky or too thin for the Operators to practicably segregate, then the topsoil would be segregated to the extent possible and stored.

- "Too rocky" would mean that the soil horizon consists of greater than 35 percent by volume rock fragments larger than 10 inches in diameter.
- "Too thin" would mean soil horizons are less than 6 inches in thickness.

- The volume of topsoil or other suitable plant growth material to be salvaged, proposed topsoil replacement depth, and topsoil storage areas will be specified in the SUP or POD.
  - If less than 6 inches of topsoil are available, topsoil could be mixed with suitable spoil, with BLM and/or landowner approval, so that a minimum of 6 inches of plant growth material is available for use during reclamation.

Soil Stockpiling and Storage

- Stored soil material will be protected from erosion, degradation, and contamination. Soil stabilization will be implemented as soon as practicable on all topsoil and spoil stockpiles.
- Vegetation will be salvaged and stockpiled along with topsoil to provide erosion protection, maintain natural inocula, and incorporate native seeds and organic matter. Additional mulching and natural tackifiers may be used to protect exposed stockpile surfaces.
- Stockpiles to be stored beyond one growing season will be seeded with a site-specific seed mixture. The seed mixture will be determined from the ecological site.
  - Seeding stockpiles with an approved and appropriately designed seed mixture (i.e., designed with locally adapted plant species unique to the specific ecological site and biophysical conditions) presents a unique opportunity to predetermine the compatibility and establishment success rate of the site-specific seed mixture.
- Topsoil and spoil stockpiles will be designed to minimize the surface area occupied and will be constructed to maintain geomorphic stability until they are used for reclamation.
- Spoil will be salvaged and stockpiled separately from topsoil. All stockpiles will be located so as not to affect existing drainages.
  - In some cases, a disturbed area may cover more than one ecological site and topsoil from each ecological site may be segregated.
  - Topsoil and spoil stockpiles will be clearly marked and noted on site diagrams.
  - Topsoil attributes and unique identifiers will be included with all shapefiles, and each stockpile will identified with the necessary signage.
  - Whenever possible, topsoil will be used immediately and not stockpiled for future use.

- Where cut-and-fill construction is required, the Operators will balance the volumes of cut versus fill material to minimize the volume of stockpiled material.

- The majority of all well pads will be constructed by balancing the cut and fill volumes to eliminate stockpiling subsoil

- Spoil will be salvaged and stockpiled separately from topsoil.

- For pipelines and access roads constructed on slopes of less than 15 percent, topsoil will be salvaged from all areas to be disturbed and stockpiled in windrows within the construction ROW by sidecasting with a grader.
  - Where pipelines and roads are to be constructed on slopes greater than 15 percent, topsoil would be transported to more level terrain for storage.

- Topsoil and spoil stockpiles will be designed to minimize the surface area occupied and will be constructed to remain stable until they are used for reclamation. Whenever possible, topsoil would be used immediately and not stockpiled for future use.

- Stockpile slopes will be 5:1 or less.

- If a topsoil stockpile is located on or adjacent to ground that slopes 3:1 or more, runoff would be diverted around the stockpile via interceptor ditches.

    - Interceptor ditches would be V-shaped—1 foot deep and 3 feet wide with gently sloping sides—and would empty onto native, undisturbed vegetation.

    - Energy dispersing devices (e.g., rock aprons) would be placed at each end of the interceptor ditch. All stockpiles will be located so as not to affect existing drainages.

- Interim reclamation would be implemented immediately on all topsoil and spoil.

- Topsoil and spoil stockpiles would be clearly marked and noted on site maps and may be identified with signs.

Soil Management – Landscape Reconstruction

Topography/Recontouring

- Landscape reconstruction will restore the disturbed area back to its approximate original landscape by recreating the physical characteristics that approximate the visual quality of adjacent areas with regard to location, scale, contour, color, and orientation of major landscape features.
- Recontouring will be accomplished through backfilling, grading, and site stabilization.
- Spoil for backfill will be obtained from fill material and any spoil stockpiles.

Stream Channels/Drainages

- Temporary stream and drainage crossings, along with associated riparian areas, will be restored to approximate pre-construction conditions following disturbances.

- Disturbances will be minimized and restored as quickly as feasible. Linear construction disturbances will be narrowed to the minimum width necessary to develop the Project.

- Temporary culvert placement will be required for live and flowing streams to maintain down-gradient water quality.

- All topsoils in drainages will be salvaged to predetermined depths for surface redistribution following development.

    - Topsoil salvage in wetlands will be segregated and redistributed by wetland zone as applicable.

- Following development, channels and swale slopes will be recontoured to allow for unrestricted surface flows with a gradient that matches adjacent undisturbed areas.

    - Embankment slopes will be recontoured to match adjacent undisturbed slopes on either side of the disturbance.

- In the event that sheer vertical embankments occur, recontouring and restoration will be addressed on a site-specific basis.

Soil Management – Soil Stabilization and Erosion Protection

Surface Runoff and Erosion Control

- Surface runoff would be controlled at all well pads using interception ditches and berms.
  - Other sediment and runoff controls that may be implemented include diversion ditches; sediment control basins; straw, hay bale, or rock check dams; sediment fences; and energy dissipaters.
- Runoff and erosion control along access road/pipeline ROWs would be accomplished by implementing standard cross drain, culvert, road ditch, and turnout design, as well as mulching and revegetation of exposed cut, fill, and road shoulders within six months of initial construction (weather permitting), per Onshore Order #1.
- All culverts would be constructed with riprapped entrances and exits using energy dissipaters or other scour-reducing techniques, where appropriate.
- Water discharged from culverts, cross drains, road ditches, and turnouts would be directed into undisturbed vegetation away from all natural drainages.
- Erosion and sedimentation control measures and structures would be installed across all cut-and-fill slopes within 100 feet of drainage channels.
- All runoff and erosion control structures would be inspected at regular intervals and after major runoff events (e.g., spring runoff, storm events) by the Operators throughout the life of the Project. Structures would be cleaned out and maintained in functional condition throughout the life of the Project (see SWPPP).
- Temporary Erosion Control
  - Temporary runoff and erosion control measures may include applying mulch and netting of biodegradable erosion control blankets stapled firmly to the soil surface, re-spreading scalped vegetation, or constructing water bars.
  - Other erosion control techniques that would be applied where necessary may include diversion ditch and sediment control basin design and construction; straw, hay, or rock check dams; sediment fences; and energy dissipaters.
  - The actual distance of a pipeline/road ROW requiring stabilization on each side of a drainage channel would 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 would be applied.
  - Silt fences or other sediment filtering devices, such as weed-free straw bales, would be installed along drainage channel banks where sedimentation is excessive and at the base of all slopes adjacent to wetlands.
  - Sediment filtering devices would be cleaned out and maintained in a 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) would not be applied to drainage channel banks. Inspections would occur after runoff events (e.g., spring runoff, storm events).
  - If construction is completed more than 30 days prior to the specified seeding season for perennial vegetation, areas adjacent to second order drainage channels or larger would be covered with jute matting for a minimum of 50 feet on either side of the drainage channel.
  - In addition, to protect soil from erosion, 2 tons/acre of weed-free straw mulch or wood chips would be applied to all slopes greater than 10 percent.

  - Temporary erosion control measures may include leaving the ROW in a roughened condition, re-spreading 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 would not be overlooked.
  - 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 would be used for pipeline construction in certain areas to prevent the flow of water in trenches that have been backfilled or temporarily left open. Trench breakers are particularly important in wetland areas to minimize subsurface drainage.
  - Trench breakers would 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 applying 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.
  - Topsoil would not be used to construct trench breakers.
  - If a pipeline crosses roads at the base of slopes, vegetative strips would be maintained. If vegetation is disturbed within these limits, temporary sediment barriers such as silt fences and/or staked weed-free straw bales would be installed at the base of the slope adjacent to the road crossing.
  - Temporary sediment barriers would remain in place until permanent revegetation measures have been judged successful.
  - All runoff and erosion control structures would be inspected, maintained, and cleaned-out by the Operators on a regular basis throughout the life of the Project. Inspections would occur after runoff events (e.g., spring runoff, storm events).
- Long-term Erosion Control
  - Runoff and erosion control along all ROWs would be accomplished by constructing sediment trapping devices (e.g., silt fences and straw bales) and water bars, as well as by timely mulching and revegetating exposed disturbed areas.
  - Runoff discharged from water bars would be directed into undisturbed vegetation away from all natural drainages.
  - Erosion and sedimentation control measures and structures would be installed across all cut-and-fill slopes.
  - All runoff and erosion control structures would be inspected after major runoff events and on a regular schedule.
  - Substandard or ineffective structures would be cleaned out and maintained in functional condition until successful revegetation and soil stability are attained.
  - Water bars would be constructed across side slopes at appropriate intervals according to slope gradient immediately following recontouring the disturbed areas. The spacing would depend on whether mulching is applied in conjunction with placement of water bars.
  - Water bars would be maintained in a functional condition throughout the life of the Project.
  - Water bars would be repaired and broadcast seeded with the seed raked into the soil should the integrity of the water bar system be disrupted during seeding.

Slope Stability

- Surface stability will be controlled by maintaining soil physical properties and treating compacted surfaces with accepted technologies.
- Erosion and sedimentation control measures and structures will be installed across all cut-and-fill slopes.
- Surface runoff and sedimentation control measures will be established by constructing sediment trapping devices and water bars, as well as by timely mulching and revegetation of exposed disturbed areas.
- Runoff discharged from water bars will be redirected into undisturbed vegetation and away from all natural drainages.
- Silt fences or other sediment filtering devices will be installed at the inside edge of proposed surface disturbances.
- Trench breakers will be used to prevent the flow of water into trenches that have been backfilled or temporarily left open.
    - Trench breakers will not be constructed from topsoil but rather from spoil.
- All runoff and erosion control structures will be inspected, maintained, and cleaned-out and inspections will be necessary following large runoff events (i.e., spring snowmelt runoff, large precipitation events, etc.).
    - Substandard or ineffective structures will be cleaned out and maintained until the desired vegetation is established and soil stability is attained at the reclaimed area.
- Turnouts, water ditches, and water bars may be constructed across side slopes at periodic intervals according to slope gradient along recontoured and disturbed slopes.
    - The spacing will partially depend on soil particle cohesiveness and whether mulching, soil binder, or tackifier is applied in conjunction with placement of water bars during earthwork reclamations.
    - Water bars will be seeded per predetermined prescriptions and repaired as needed throughout the life of the Project or until final reclamation measures are deemed successful.

Surface Stability

- Prior to reclamation, susceptible soils will be tested to determine the level of compaction and highly compacted areas will be identified for additional aerating and ripping.
- Ripping and aerating will be necessary for all roads and facilities; however, this measure will not be necessary for all surface disturbance activities, but will be determined at the site-specific level with compaction testing of susceptible soils.

Subsurface Integrity

- Subsurface stabilization will include compaction of redistributed subsoils to Project design standards, as applicable.

- Water quality will be maintained during surface-disturbing activities using BMPs and reclamation prescriptions predefined in the SUPs, SWPPP, and in compliance with the Clean Water Act (CWA).

- Trench breakers made from sand bags or prefabricated concrete bags may be used at the outer extents of wetlands and drainage crossings to minimize the potential for any ‘French drain’ effect or inadvertent subsurface drainage of water bodies.

- Trench breakers may also be used to prevent ‘piping’ or lateral subsurface water movement along trenched gathering lines in areas where collecting lines parallel water bodies and stream courses.

- Disturbance to ephemeral and intermittent drainage channels would be avoided and/or minimized. All channel crossings not maintained for access roads would be restored to near-pre-disturbance conditions.
- Drainage channel bank slope gradients would be regraded to conform to adjacent slope gradients.
- Channel crossings would be designed to minimize changes in channel geometry and subsequent changes in flow hydraulics.
- Culverts would be installed for ephemeral and intermittent drainage channel crossings.
- All drainage channel-crossing structures would be designed to carry the 25- to 50-year discharge event, as directed by the BLM.
- Silt fences would be constructed at the base of slopes at all drainage channel crossings.
- To avoid washes, minor routing variations would be implemented during access road, pipeline, and well pad layout. Disturbance in the vicinity of washes would be minimized.
- Trench plugs would be employed at non-flumed drainage crossings to prevent diversion of drainage channel flows into upland portions of pipeline trenches during construction.
- Applying riprap would be limited to areas where flow conditions prevent vegetative stabilization; riprap activities must comply with U.S. Army Corps of Engineers permit requirements.
- Pipeline trenches would be dewatered in such a manner that no silt-laden water flows into active drainage channels (i.e., prior to discharge the water would be filtered through a silt fence, weed-free straw bales, or allowed to settle in a sediment detention pond).

Soil Management – Site Preparation

Waste Material Management

- All contaminated soils will be transported, managed, and disposed of according to procedures outlined in the SUPs and the Storm Water Pollution Prevention Plan (SWPPP).

- The construction contractor will keep all hazardous, non-hazardous, special, and general trash wastes separate and will not mix waste streams.

- Topsoil will not be replaced on contaminated material—all contaminated material would be removed or otherwise handled in accordance with the Spill Prevention, Control, and Countermeasure Plan (SPCC).

- Hazardous material will be managed and disposed of as predetermined in the SUPs.

Backfilling and Grading

- Backfilling will occur prior to grading.

- Areas to be backfilled include flare pits, reserve pits, cut slopes, pipeline trenches, borrow ditches, and facility foundations.

- Pipeline trenches will be backfilled so that the soil berm is less than 3 inches high.

- Spoil for backfill will be obtained from fill material and spoil stockpiles.

- Areas to be reclaimed will be graded to approximate original contours and to blend in with adjacent topography.

- Area-wide drainage will be restored so that surface runoff flows and gradients are returned to the conditions present prior to development.
- Graded surfaces would be suitable for the replacement of a uniform depth of topsoil, would promote cohesion between subsoil and topsoil layers, would reduce wind erosion, and would facilitate moisture capture.
- Specialized grading techniques will be applied and may include slope rounding, bench grading, stair-step grading, and/or contour furrowing.

Ripping and Discing

- Compacted areas such as roads and well pads will be ripped to a depth of approximately 2 feet to improve soil aeration, water infiltration, and root penetration.
- Ripped areas will be disced, if necessary, to fill in deep furrows (where topsoil would be lost) and break up large clods (to which topsoil would not adhere).
- Ripper shanks would be set approximately 1 to 2 feet apart. Discing is typically accomplished using a tractor-drawn disc set 2 to 6 inches deep.

Topsoil Replacement

- Waterbars and erosion control devices will be installed on reclaimed areas prior to topsoil replacement, as necessary, to control topsoil erosion.
- Between 6 and 24 inches of stockpiled topsoil will be redistributed uniformly on areas to be reclaimed.
    - If the stockpile for a given location contains insufficient topsoil to meet the required 6-inch minimum, topsoil will be mixed with suitable spoil or imported from another location.
- Once topsoil is replaced, seeding will occur within two weeks unless the ground is wet or frozen.
    - In this circumstance, seeding will be delayed until the ground dries or thaws to the point where soils are friable.
    - An early frost is not an indicator to warrant delay of the seeding procedure if subsequent weather conditions are appropriate for seeding.

Discing

- After topsoil replacement, newly topsoiled areas will be disced or harrowed to reduce soil compaction, to break up soil clods, to improve root and water penetration, and to provide a friable but firm seedbed.
- The surface would be rough to reduce wind and water erosion and to promote moisture capture.
- If the surface is roughened during discing, other moisture-capture techniques probably are not needed.
    - However, the Operators have the full discretion to implement techniques such as pitting and gouging to concentrate water in pits and gouges.

- Discing and harrowing are typically accomplished using a tractor-drawn disc or harrow set 2 to 6 inches deep.

Mulching

- Where mulching is deemed necessary, the reclaimed area will be uniformly mulched (75 percent minimum cover) with certified weed-free native grass, hay, small grain straw, wood fiber, and/or live mulch, at a rate of 2 tons/acre. Mulch would protect the soil from wind and water erosion, raindrop impact, surface runoff, and would help hold seeds in place. Mulching may occur prior to or after broadcast seeding but must occur after drill seeding.
    - Alternatively, cotton, jute, or synthetic netting would be applied. Mulch would be crimped into the soil, tackified, or incorporated into erosion control blankets to prevent it from blowing or washing away and from entering waterways.
- On steep slopes where it is unsafe to operate equipment, at sites where soils have 35 percent or more surface rock content, or on notably unstable areas, hydromulch, biodegradable erosion control netting, or matting will be firmly attached to the soil surface.

Site Preparation – Soil Materials

Re-establish Chemical, Physical, and Biological Properties

- If multiple topsoils were stockpiled, stockpiles will be marked with stakes and flagging and the correct topsoil will be redistributed to the appropriate depth according to ecological site.
- If the stockpile for a given location contains insufficient topsoil to for redistribution, topsoil will be mixed with suitable spoil or imported from another stockpile with similar properties (i.e., same ecological site).

Compaction

- After topsoil replacement, compacted soils will be disced or harrowed to reduce soil compaction, break up soil clods, improve root and water penetration, and provide a friable but firm seedbed. Discing and harrowing are typically accomplished using a tractor-drawn disc or harrow.
- The surface will be roughened to reduce wind and water erosion and promote moisture capture. If the surface is roughened during discing, other moisture-capture techniques will not be necessary.

Protect Seeding Surface

- Reclaimed areas will be uniformly mulched with certified weed-free native grass, hay, small grain straw, wood straw, and/or live mulch at a rate sufficient to maintain appropriate cover.

Soil Conditioning

- Topsoil and spoil would be tested, and amendments will be added so that it meets suitable criteria for topsoil. A variety of soil amendment protocols are available to make soils more suitable for vegetation establishment.
- In addition, no unsuitable materials will be used, and no fertilizers will be used near open water.

- Alternatively, the Operators would identify other topsoil stockpile(s) from which topsoil would be obtained for reclamation.

Revegetation

Seeding Program

- Seeding will be conducted in the fall between September 15 and freeze-up.
    - If fall seeding is not feasible, seeding may occur between spring thaw and May 15.
- Seeds will be planted along contour using a rangeland drill equipped with an agitator and depth bands to mix seed and ensure proper seeding depths.
- Seeds would be planted 0.25 to 0.50 inch deep. Fluffy seeds (e.g., winterfat) will be broadcast simultaneously with drilled seeding.
- Broadcast seeding may be used for other shrub and forb species, utilizing either hand or specialized broadcast seeders.
- When drill-seeding is not practical due to steep slopes, rocky surfaces, or wet soil conditions, seeding rates will be doubled, seeds will be broadcast, and the area will be raked or chained to cover seeds.
- The Operators may elect to broadcast seed after applying and crimping 2 tons/acre of certified weed-free mulch.
- The Operators may elect to hand-plant bare-root or containerized shrub stock to facilitate shrub establishment. It is not required for the first-time attempt at final reclamation but may be required at a later date by BLM if reclamation success is not achieved.

Seeding Method

- Drill seeding or other appropriate planting methods could be used where the terrain is accessible by equipment.
    - The planting depth for most forage species is 1/4 to 1/2 inch (5 to 10 millimeters).
    - A double-disc drill equipped with depth bands, a seed agitator, and packer wheels ensures optimum seed placement. The seed would be separated by boxes to prevent separation due to size and weight. Rice hulls or other appropriate material would be added to the seed as necessary to prevent separation.
    - The drill would be properly calibrated so that seed is distributed according to the rates specified for each seed mixture.
    - If a sagebrush/grass mix is used, it is recommended to partition the seed boxes and drill to allow the slower developing shrub seeds to be planted in separate rows from the more rapidly developing grass and forb seeds.
    - In areas where the goal is to simulate a natural appearance, the site would be drilled in multiple, cross, overlapping patterns. This would eliminate the row crop appearance of the site.

- Broadcast seeding may be used where appropriate.
    - Broadcasted seeding would occur on a rough seedbed and then would be lightly harrowed, chained, or raked to cover the seed.
    - The seeding rate for broadcast seeding would be double the recommended seeding rate of the mixtures developed for drill seeding.
    - The method selected to cover the seed would ensure that the seed is lightly covered but maintains the surface in rough condition. The broadcast seeder would be properly calibrated or the seeding would occur over a calculated known area so that the proper seeding rate is applied.
- The Operators are strongly encouraged to consider staggered seeding methods to facilitate the establishment of shrubs and/or to revegetate areas with poor quality substrates (e.g., see Coenenberg 1982; DePuit 1982).
    - Small seeded species (e.g., big sagebrush) establish best when the seed is broadcast and lightly covered. Broadcasting sagebrush seed directly onto snow can achieve good results (NRCS 2006).
- Any soil disturbance that occurs outside the recommended permanent seeding season, or any bare soil left unstabilized by revegetation, would be treated as winter-construction and mulching would be considered or the site would be stabilized.

Greater Sage-grouse Habitat

Preliminary Priority Habitat – Additional Required Design Features (RDFs)

- Where existing leases or ROWs have had some level of development (road, fence, well, etc.) and are no longer in use, reclaim the site by removing these features and restoring the habitat.
- Coordinate BMPs and vegetative objectives with NRCS for consistent application across jurisdictions where the BLM, Forest Service, and NRCS have the greatest opportunities to benefit Greater Sage-Grouse, particularly as it applies to the NRCS's National Sage-Grouse Initiative.
- Evaluate the role of existing seedings that are currently composed of primarily introduced perennial grasses in and adjacent to priority sage-grouse habitats to determine if they should be restored to sagebrush or habitat of higher quality for sage-grouse.
    - If these seedings are part of an AMP/Conservation Plan, or if they provide value in conserving the rest of the priority habitat, then no restoration would be necessary.
    - Assess the compatibility of these seedings for sage-grouse habitat or as a component of a grazing system during land health assessments (Davies et al. 2011). For example, some introduced grass seedings are an integral part of livestock management plans and reduce grazing pressure in important sagebrush habitat, or serve as a strategic fuels management area.
- Require sage-grouse safe fences.
- Construct road crossings of ephemeral, intermittent, and perennial streams to minimize impacts to the riparian habitat, such as by crossing at right angles to ephemeral drainages and stream crossings.

- Close and rehabilitate duplicate roads by restoring original landform and establishing desirable vegetation.
- Control the spread and effects of invasive non-native plant species (Evangelista et al. 2011), including treating weeds prior to surface disturbance and washing vehicles and equipment at designated wash stations when constructing in areas with weed infestations.
- Clean up refuse (Bui et al. 2010).
- Consider using oak (or other material) mats for drilling activities where topography permits to reduce vegetation disturbance and for temporary roads between closely spaced wells to reduce soil compaction and maintain soil structure to increase likelihood of vegetation reestablishment following drilling.
- Limit noise to less than ten decibels above ambient measures (20-24 dBA) at sunrise at the perimeter of a lek during active lek season (Patricelli et al. 2010, Blickley et al. 2012).
- Use vegetation treatment prescriptions to minimize undesirable effects on vegetation or soils (e.g., minimize mortality of desirable plant species and reduce risk of hydrophobicity).
- Power wash all vehicles and equipment involved in vegetation treatment activities prior to entering the area to minimize the introduction of undesirable and/or invasive plant species.
- Restore prior perennial grass/shrub plant communities infested with non-native invasive species to a species composition characterized by perennial grasses, forbs, and shrubs as outlined in ESDs.
- Emphasize the use of native plant species, recognizing that non-native species may be necessary depending on the availability of native seed and prevailing site conditions.
- Make reestablishment of sagebrush and desirable understory plant cover (relative to ecological site potential) a high priority for restoration efforts. Write specific vegetation objectives to reestablish sagebrush cover and desirable understory cover.

Preliminary General Habitat – Recommended RDFs

- Include restoration objectives to meet sage-grouse habitat needs in reclamation practice/sites (Pyke 2011). Address post reclamation management in reclamation plan such that goals and objectives are to enhance and restore sage-grouse habitat.
- Construct road crossing at right angles to ephemeral drainages and stream crossings.
- Close and reclaim duplicate roads by restoring original landform and establishing desired vegetation.
- Clean up refuse (Bui et al. 2010)
- Control the spread and effects from non-native plant species (e.g., by washing vehicles and equipment).

Attachment C

Seed Mix Species Pick Lists

Table C-1. Recommended seed pick list for saline upland ecological sites.

Common Name	Scientific Name	Symbol	Growth Form
Alkali sacaton	*Sporobolus airoides*	SPAI	Grass
Bottlebrush squirreltail	*Elymus elymoides*	ELEL5	Grass
Indian ricegrass	*Achnatherum hymenoides*	ACHY	Grass
Inland saltgrass	*Distichlis spicata*	DISP	Grass
Sandberg bluegrass	*Poa secunda*	POSE	Grass
Streambank wheatgrass	*Elymus lanceolatus ssp. lanceolatus*	ELLAL	Grass
Western wheatgrass	*Pascopyrum smithii*	PASM	Grass
Aster	*Aster* spp.	ASTER	Forb
Milkvetch	*Astragalus* spp.	ASTRA	Forb
Tapertip hawksbeard	*Crepis acuminata*	CRAC2	Forb
Upright prairie coneflower	*Ratibida columnifera*	RACO3	Forb
Violet prairie clover	*Dalea purpurea*	DAPU5	Forb
White prairie clover	*Dalea candida*	DACA7	Forb
Woodyaster	*Xylorhiza* spp.	XYLOR	Forb
Gardner's saltbush	*Atriplex gardneri*	ATGA	Shrub
Greasewood	*Sarcobatus vermiculatus*	SAVE4	Shrub
Winterfat	*Krascheninnikovia lanata*	KRLA2	Shrub

Table C-2. Recommended seed pick list for mesic ecological sites.

Common Name	Scientific Name	Symbol	Growth Form
Basin wildrye	*Leymus cinereus*	LECI4	Grass
Blue grama	*Bouteloua gracilis*	BOGR2	Grass
Buffalograss	*Buchloe dactyloides*	BUDA	Grass
Canada wildrye	*Elymus canadensis*	ELCA4	Grass
Green needlegrass	*Nassella viridula*	NAVI4	Grass
Needle and thread	*Hesperostipa comata*	HECO26	Grass
Prairie Junegrass	*Koeleria macrantha*	KOMA	Grass
Sandberg bluegrass	*Poa secunda*	POSE	Grass
Slender wheatgrass	*Elymus trachycaulus*	ELTR7	Grass
Streambank wheatgrass	*Elymus lanceolatus* ssp. *lanceolatus*	ELLAL	Grass
Western wheatgrass	*Pascopyrum smithii*	PASM	Grass
Aster	*Aster spp.*	ASTER	Forb
Bluebells	*Mertensia* spp.	MERTE	Forb
Desertparsley	*Lomatium* spp.	LOMAT	Forb
Milkvetch	*Astragalus* spp.	ASTRA	Forb
Prairie sagewort	*Artemisia frigida*	ARFR4	Forb
Sulphur-flower buckwheat	*Eriogonum umbellatum*	ERUM	Forb
Tapertip hawksbeard	*Crepis acuminata*	CRAC2	Forb
Upright prairie coneflower	*Ratibida columnifera*	RACO3	Forb
Violet prairie clover	*Dalea purpurea*	DAPU5	Forb
Yarrow	*Achillea* spp.	ACHIL	Forb
Big sagebrush	*Artemisia tridentata*	ARTR2	Shrub
Rubber rabbitbrush	*Ericameria nauseosa*	ERNA10	Shrub
Silver sagebrush	*Artemisia cana* ssp. *cana*	ARCAC5	Shrub
Western snowberry	*Symphoricarpos occidentalis*	SYOC	Shrub
Winterfat	*Krascheninnikovia lanata*	KRLA2	Shrub
Wood's rose	*Rosa woodsii var. woodsii*	ROWOW	Shrub

Table C-3. Recommended seed pick list for loamy/clayey ecological sites.

Common Name	Scientific Name	Symbol	Growth Form
Blue grama	*Bouteloua gracilis*	BOGR2	Grass
Bluebunch wheatgrass	*Pseudoroegneria spicata*	PSSP6	Grass
Bottlebrush squirreltail	*Elymus elymoides*	ELEL5	Grass
Buffalo grass	*Buchloe dactyloides*	BUDA	Grass
Fendler threeawn	*Aristida purpurea* var. *longiseta*	ARPUL	Grass
Green needlegrass	*Nassella viridula*	NAVI4	Grass
Indian ricegrass	*Achnatherum hymenoides*	ACHY	Grass
Little bluestem	*Schizachyrium scoparium*	SCSC	Grass
Needle and thread	*Hesperostipa comata*	HECO26	Grass
Prairie Junegrass	*Koeleria macrantha*	KOMA	Grass
Sandberg bluegrass	*Poa secunda*	POSE	Grass
Sideoats grama	*Bouteloua curtipendula*	BOCU	Grass
Streambank wheatgrass	*Elymus lanceolatus* ssp. *lanceolatus*	ELLAL	Grass
Western wheatgrass	*Pascopyrum smithii*	PASM	Grass
Aster	*Aster* spp.	ASTER	Forb
Bluebells	*Mertensia* spp.	MERTE	Forb
Desertparsley	*Lomatium* spp.	LOMAT	Forb
Milkvetch	*Astragalus* spp.	ASTRA	Forb
Prairie coneflower	*Ratibida columnifera*	RACO3	Forb
Purple prairie clover	*Dalea purpurea*	DAPU5	Forb
Sulphur-flower	*Eriogonum umbellatum*	ERUM	Forb
Tapertip hawksbeard	*Crepis acuminata*	CRAC2	Forb
White prairie clover	*Dalea candida*	DACA7	Forb
Yarrow	*Achillea* spp.	ACHIL	Forb
Big sagebrush	*Artemisia tridentata*	ARTR2	Shrub
Rubber rabbitbrush	*Ericameria nauseosa*	ERNA10	Shrub
Silver sagebrush	*Artemisia cana* ssp. *cana*	ARCAC5	Shrub
Skunkbush sumac	*Rhus trilobata*	RHTR	Shrub
Winterfat	*Krascheninnikovia lanata*	KRLA2	Shrub

Table C-4. Recommended seed pick list for sandy ecological sites.

Common Name	Scientific Name	Symbol	Growth Form
Blue grama	*Bouteloua gracilis*	BOGR2	Grass
Bluebunch wheatgrass	*Pseudoroegneria spicata*	PSSP6	Grass
Indian ricegrass	*Achnatherum hymenoides*	ACHY	Grass
Little bluestem	*Schizachyrium scoparium*	SCSC	Grass
Needle and thread	*Hesperostipa comata*	HECO26	Grass
Prairie Junegrass	*Koeleria macrantha*	KOMA	Grass
Prairie sandreed	*Calamovilfa longifolia*	CALO	Grass
Sand bluestem	*Andropogon hallii*	ANHA	Grass
Sand dropseed	*Sporobolus cryptandrus*	SPCR	Grass
Sandberg bluegrass	*Poa secunda*	POSE	Grass
Sideoats grama	*Bouteloua curtipendula*	BOCU	Grass
Streambank wheatgrass	*Elymus lanceolatus* ssp. *lanceolatus*	ELLAL	Grass
Western wheatgrass	*Pascopyrum smithii*	PASM	Grass
Aster	*Aster* spp.	ASTER	Forb
Bluebells	*Mertensia* spp.	MERTE	Forb
Desertparsley	*Lomatium* spp.	LOMAT	Forb
Milkvetch	*Astragalus*	ASTRA	Forb
Prairie sagewort	*Artemisia frigida*	ARFR4	Forb
Sulphur-flower buckwheat	*Eriogonum umbellatum*	ERUM	Forb
Tapertip hawksbeard	*Crepis acuminata*	CRAC2	Forb
Upright prairie coneflower	*Ratibida columnifera*	RACO3	Forb
Violet prairie clover	*Dalea purpurea*	DAPU5	Forb
White prairie clover	*Dalea candida*	DACA7	Forb
Yarrow	*Achillea* spp.	ACHIL	Forb
Big sagebrush	*Artemisia tridentata*	ARTR2	Shrub
Fourwind saltbush	*Atriplex canescens*	ATCA2	Shrub
Silver sagebrush	*Artemisia cana* ssp. *cana*	ARCAC5	Shrub
Skunkbush sumac	*Rhus trilobata*	RHTR	Shrub
Soapweed yucca	*Yucca glauca*	YUGL	Shrub
Western snowberry	*Symphoricarpos occidentali*	SYOC	Shrub
Winterfat	*Krascheninnikovia lanata*	KRLA2	Shrub
Yellow rabbitbrush	*Chrysothamnus viscidiflorus*	CHVI8	Shrub

Attachment D

Noxious and Invasive Weed Species Management Plan

Introduction

Noxious and invasive non-native plant species that are difficult to control, easily spread, and are injurious to public health, crops, livestock, land or other property are designated as noxious weeds under the Wyoming Weed and Pest Control Act of 1973. Species targeted for control under this Weed Management Plan are State of Wyoming designated noxious weeds, and Converse County declared problem weeds. Prohibited noxious weeds pursuant to Wyoming Statute (W.S.) 11-12-104 and the 2014 Weed and Pest Declared List by County are identified below.

This Weed Management Plan will be used employed on APDs approved on the Converse County Project to aid in the restoration of disturbed areas and (1) allow the prevention and detection of new infestations of noxious weed in and around project area; (2) guide the monitoring of existing infestations; and (3) provide methods for the control of existing populations.

This weed management plan outlines approaches to be used in noxious and invasive weed species planning, prevention, control actions. In addition, this plan describes noxious and invasive weed monitoring techniques. Measures for prevention, detection and rapid response are discussed in the following sections.

Prevention - Pre-disturbance Site Planning

Incorporate prevention measures into site layout and design.

- Design site footprint to avoid unnecessary soil disturbance where possible.

- Devise a plan that prevents weed colonization by minimizing exposure to seed dispersal vectors and susceptibility to infestation during on-site inspection prior to construction.

Conduct baseline evaluation of site conditions for weed infestations and susceptibility to infestation prior to construction.

- Pre-disturbance monitoring assesses site and ecological condition including:
  - Soil assessment.
  - Vegetation assessment.
  - Site photos documenting overall site condition for the duration of the project.

- Treat all noxious weeds and invasive non-desirable species prior to construction, both on-site and along roadways.

Prevention - Site Development

Incorporate prevention measures into site development activities.

- Minimize soil disturbance to the extent possible.
- Prevent weed germination and establishment by retaining native vegetation around site.
- Locate and use weed free project staging areas.
- Maintain equipment free of noxious weed seeds/propagules when entering the field or when moving between sites that have known infestations.
  - When wash stations are available, wash or brush down equipment (tractors, seed drills, straw crimpers, etc.) when moving from areas with weed presence or potentially with weed presence

to areas that do not have known infestations.
– Avoid travel through areas with known infestations.

Prevention – Revegetation

Incorporate prevention measures into revegetation.

- Revegetate with native grasses and simple forbs. The seeding application will include a mix of forbs and grasses for diversity. Seed mixes will be prescribed either by the surface landowner or the BLM/USFS.
- Maintain topsoil stockpiles in a weed-free condition through treatment and use of sterile and/or desired native cover crops.
- Inspect seed, straw mulch (including wattles, straw bales, dams, etc.) and gravel and accept only certified 'weed-free' material.

Prevention – Education

Facilitate prevention measures through education.

- Weed identification will be taught to reclamation contractor personnel for training and weed occurrence data quality assurance purposes.
- Weed workshops will be scheduled annually. In addition, noxious weed identification and common pathways of infestation will be added to safety meetings for all reclamation contractor personnel.
- Post weed awareness messages at strategic locations so that they are visible to all field workers.

Detection - Vegetation Monitoring

Conduct monitoring programs to detect new infestations and determine extent of existing noxious weed populations.

- The restoration program as it relates to weeds incorporates field wide vegetation monitoring.
- Vegetation monitoring is conducted by trained personnel knowledgeable of the local vegetation, weeds, and community ecology. Threatened and Endangered Species/federal agency Sensitive Species found during vegetation monitoring will be reported to the Casper BLM Field Office or USFS Medicine Bow-Routt National Forests and Thunder Basin National Grassland.
- Every pad or lease and associated infrastructure (roads, pipelines, etc.) will be monitored for the presence of noxious or invasive, non-desirable species annually.
- Conduct monitoring in late spring to assess new germination and allow for immediate response. Species and size of each infestation will be documented.

Rapid Response - Access infestation risk

- Analyze weed occurrence and severity data, status of the revegetation, and condition of off-site vegetation (community type).
- From analysis determine a plan of action for control of infestation (e.g. chemical, mechanical, biological, no action – continue to monitor).

Methods for the Control of Existing Populations

Noxious weeds and invasive non-desirable species will be controlled on all well pad leases, facilities,

pipelines and associated project areas. Vegetation monitoring (detection and analysis) will dictate the required control measures.

- BLM Manual 9011 (*Chemical Pest Control* - policies), BLM Handbook H-9011-1 (*Chemical Pest Control* - procedures), and Forest Service Manual 2100 (*Chapter 2150 - Pesticide-Use Management And Coordination*) will be used to guide herbicide planning and use on public lands.
- On public land, an approved Pesticide Use Permit will be obtained to apply chemical herbicides.
- Spraying activities will start in late spring after target weeds are large enough and temperatures are conducive for herbicide uptake for effective control. Herbicide application will continue until all locations and roads are effectively treated. Treated sites will be monitored for efficacy of application. Follow-up applications will be administered as needed based on analysis of monitoring reports. The target date of completion is late summer before plants set viable seed.
    - The chemical(s) used for control of noxious and invasive weeds will be approved by the BLM or USFS.
    - All chemicals will be applied according to label directions to ensure environmental safety, chemical efficacy, and cost-effectiveness of treatment.
- A bare ground application will be applied to control weeds and vegetation around equipment and facilities. Bare ground applications will be made at least every two years and will target areas that need to be free of vegetation to prevent fire hazards in and around equipment on pad locations.
    - Bare ground applications will start in the early spring as soon as the snow comes off the ground with operations being maintained until all sites have been effectively treated. The target date for completion of bare ground applications will be late spring before the soil moisture is lost.
    - All chemicals will be applied according to label directions to ensure environmental safety, chemical efficacy, and cost-effectiveness of treatment.

Wyoming Weed and Pest Control Act State Designated Weeds

Field bindweed	*Convolvulus arvensis*
Canada thistle	*Cirsium arvense*
Leafy spurge	*Euphorbia esula*
Perennial sowthistle	*Sonchus arvensis*
Quackgrass	*Agropyron repens*
Hoary cress (whitetop)	*Cardaria draba*
Perennial pepperweed (giant whitetop)	*Lepidium latifolium*
Ox-eye daisy	*Chrysanthemum leucanthemum*
Skeletonleaf bursage	*Franseria discolor*
Russian knapweed	*Centaurea repens*
Yellow toadflax	*Linaria vulgaris*
Dalmatian toadflax	*Linaria dalmatica*
Scotch thistle	*Onopordum acanthium*
Musk thistle	*Carduus nutans*
Common burdock	*Arctium minus*
Plumeless thistle	*Carduus acanthoides*
Dyers woad	*Isatis tinctoria*
Houndstongue	*Cynoglossum officinale*
Spotted knapweed	*Centaurea maculosa*
Diffuse knapweed	*Centaurea diffusa*
Purple loosestrife	*Lythrum salicaria*
Saltcedar	*Tamarix* spp.
Common St. Johnswort	*Hypericum perforatum*
Common Tansy	*Tanacetum vulgare*
Russian olive	*Elaeagnus angustifolia*

Converse County Declared Weed List

Black henbane	*Hyoscyamus niger*
Bull thistle	*Cirsium vulgare*
Chicory	*Cichorium intybus*
Common crupina	*Crupina vulgaris*
Common mullein	*Verbascum thapsus*
Dames rocket	*Hesperis matronalis*
Goatsrue	*Galega officinalis*
Gorse	*Ulex europaeus*
Halogeton	*Halogeton glomeratus*
Iberian starthistle	*Centaurea iberica*
Italian thistle	*Carduus pycnocephalus*
Jointed goatgrass	*Aegilops cylindrica*
Meadow knapweed	*Centaurea pratensis*
Medusahead	*Taeniatherum caput-medusae*
Orange hawkweed	*Hieracium aurantiacum*
Plains larkspur/Geyer larkspur	*Delphinium geyeri*
Purple starthistle	*Centaurea calcitrapa*
Rush skeletonweed	*Chondrilla juncea*
Sandbur	*Cenchrus incertus*
Scentless chamomile	*Matricaria perforata*
Scotch broom	*Cytisus scoparius*
Squarrose knapweed	*Centaurea virgata* ssp. *Squarrosa*
Sulfur cinquefoil	*Potentilla recta*
Syrian beancaper	*Zygophyllum fabago*
Tansy ragwort	*Senecio jacobaea*
Teasel	*Dipsacus fullonum*
Wild licorice	*Glycyrrhiza lepidota*
Yellow hawkweed	*Hieracium fendleri*
Absinth wormwood	*Artemisia absinthium*
Baby’s breath	*Gypsophila paniculata*
Musk mustard	*Chorispora tenella*

Campbell County Declared Weed List

Common cocklebur	*Xanthium strumarium*
Black henbane	*Hyoscyamus niger*
Buffalobur	*Solanum rostratum*