

APPENDIX B

GrSG DISTURBANCE GUIDELINES

GUIDELINES FOR GREATER SAGE-GROUSE PROTECTION FROM POPULATION AND HABITAT DISTURBANCE

These guidelines are designed to protect GrSG populations and habitat from human-influenced activities. They should be used in conjunction with the “Conservation Strategy” section of this plan (pg. 306), which is designed to provide strategies and approaches to address the issues in GrSG conservation. For instance, a strategy may state that a particular habitat should be avoided during a certain period, and then may refer the reader to the disturbance guidelines to clarify the season and area to be avoided. The strategy may also state that the habitat should be avoided *when technically feasible*, but the guidelines may state specifically that habitat should be avoided. This example highlights the crux of the problem when human activities must occur (from a societal perspective), and the activities can’t avoid impacting sage-grouse. The guidelines indicate how to avoid or minimize impact, using the current best available science. The strategies take into account technical reality; the ideal is to follow the guidelines, but the reality is that in some cases, that may not be possible, and the strategies provide guidance for those situations. These guidelines should be updated and modified as new information about GrSG, GrSG habitat, and human-caused impacts, becomes available. **As with all guidelines, adaptive approaches should be used and the best available science should be applied when implementing these guidelines.**

We recommend readers review the entire set of guidelines to assure an understanding of how the issues and topics are addressed, especially because they may be organized differently from other guidance documents or approaches. These Disturbance Guidelines are organized into 2 relatively distinct types of disturbance. The first type of disturbance is categorized as “Habitat Disturbance”, and the second is “Functional Bird Disturbance”.

Habitat Disturbance includes, but is not limited to, any actions that modify or change the quality, quantity, and/or or juxtaposition of habitat (see “Habitat: Fragmentation, Quality, and Quantity”, pg. 151) at the local, regional, or landscape level. Habitat Disturbance can include the modification of or change in the horizontal or vertical structure (e.g., sagebrush height or cover) of the habitat. Although new water developments and ponds in GrSG habitat are not discussed in this section, note that they should be designed to discourage mosquito production in order to minimize WNV risk to GrSG.

Functional Bird Disturbance refers to actions or features that can directly influence the survival or behavior of GrSG individuals or local populations. This type of disturbance can be illustrated by activities that may have a direct influence on bird survival (e.g., fence collision), or that may impact bird behavior, even to the point where grouse are displaced from habitat (e.g., natural gas compressor stations near leks, recreational lek viewing). These types of anthropogenic disturbances would be above and beyond normal disturbance from predators or weather. Guidelines for this type of disturbance are intended to reduce the level of disturbance of males and females attending leks. There are perceived consequences to GrSG of increased disturbance during all seasons. For instance, because GrSG are a lekking species, disturbances that interfere with mating activities include (1) a shift in the particular males breeding, including males breeding with females away from the lek; or (2) increased disturbance that eventually causes

birds to abandon the lek. During nesting season, female GrSG are extremely vulnerable to disturbance at nests, which can lead to nest abandonment. There are also concerns that disturbed birds may increase their movements, resulting in physiological consequences such as the expenditure of energy reserves during periods of high energy consumption (e.g., lekking period and winter). Physiological effects of disturbance and displacement to less suitable habitat can include chronic stress, reduced immunocompetence, reduced growth, greater susceptibility to predation and disease, and reduced body size.

The guidelines for each type of disturbance (“Habitat Disturbance” and “Functional Bird Disturbance”) are organized first by whether the seasonal habitats in question (e.g., breeding, summer-fall, winter) are mapped, or unmapped (and thus, designated by the circles in Fig. B-1). Within those categories the guidelines are then organized by the issue related to the disturbance (e.g., sagebrush manipulation, anthropogenic features, herbivory, oil and gas development).

Successful implementation of these guidelines for protecting GrSG from disturbance requires the identification and delineation (e.g., mapping, ground validation of mapping efforts) of breeding, summer-fall, and winter habitats (see “Designation of Seasonal Habitats”, following). All anthropogenic features (e.g., powerlines, roads, fences, gas wells, etc.) should also be identified and delineated. Colorado GrSG habitat use and movement data were used to develop these guidelines, but if local data were not available, guidelines are consistent with Connelly et al. (2000c). As new or local information becomes available through research or monitoring, these guidelines may be adjusted to more effectively manage GrSG.

For the purpose of these guidelines, we primarily adopt the Connelly et al. (2000c) definition of an active lek as an open area that has been attended by ≥ 2 male sage-grouse in ≥ 2 of the previous 5 years. However, this definition is derived mainly from observations of leks in large, stable populations and may not be appropriate for small populations with reduced numbers of males attending leks in fragmented sagebrush communities. Therefore, for smaller populations (i.e., Meeker - White River and Laramie River) that are isolated or disjunct from larger, more stable populations, an active lek is defined as an open area where 1 or more sage-grouse have been observed on more than 1 occasion, engaging in courtship or breeding behavior. An area used by displaying males in the last 5 years is considered an active lek. Buffers for protection from disturbance (described in following text) need to be measured from the perimeter of the open area defining the lek, not from a center point within the lek area. This is because in some situations, leks can span several acres.

If habitat disturbances that will require habitat restoration occur, the potential community needs to be identified (Winward 2004) and a diverse seed mixture of native shrubs, grasses, and forbs should be used with standard restoration or reclamation techniques (Monsen 2005).

Designation of Seasonal Habitats

If seasonal habitats have been mapped, see the section “Mapped Seasonal Habitats”. If habitats have not been mapped, see “Unmapped Seasonal Habitats”.

Unmapped Seasonal Habitats

Breeding Habitat and Summer-Fall Habitat - If these seasonal habitats are not mapped and field-validated, they should be designated by 2 concentric circles around active leks (Fig. B-1). The first circle has a radius of 0.6 miles (“Lek Habitat” portion of the Breeding Habitat), and the second has a radius of 4.0 miles, which encompasses the nesting and early-brood-rearing habitat and summer–fall habitat (Fig. B-1). Generally, breeding habitat is considered to be sagebrush communities within the 4-mile radius. Summer-fall habitat includes sagebrush communities, wet meadows, and agricultural fields within the 4-mile radius.

On federal lands, the 0.6 mile radius area around a lek in breeding habitat could be defined as an area of No Surface Occupancy (NSO) or Avoidance Area (AA). Every possible opportunity to avoid or minimize the impact should be exhausted to prevent development in this area, but allowances are provided in these guidelines. The 4-mile radius is **not** an NSO or AA. It is an area of consideration where the disturbance guidelines should be applied when, and if, possible.

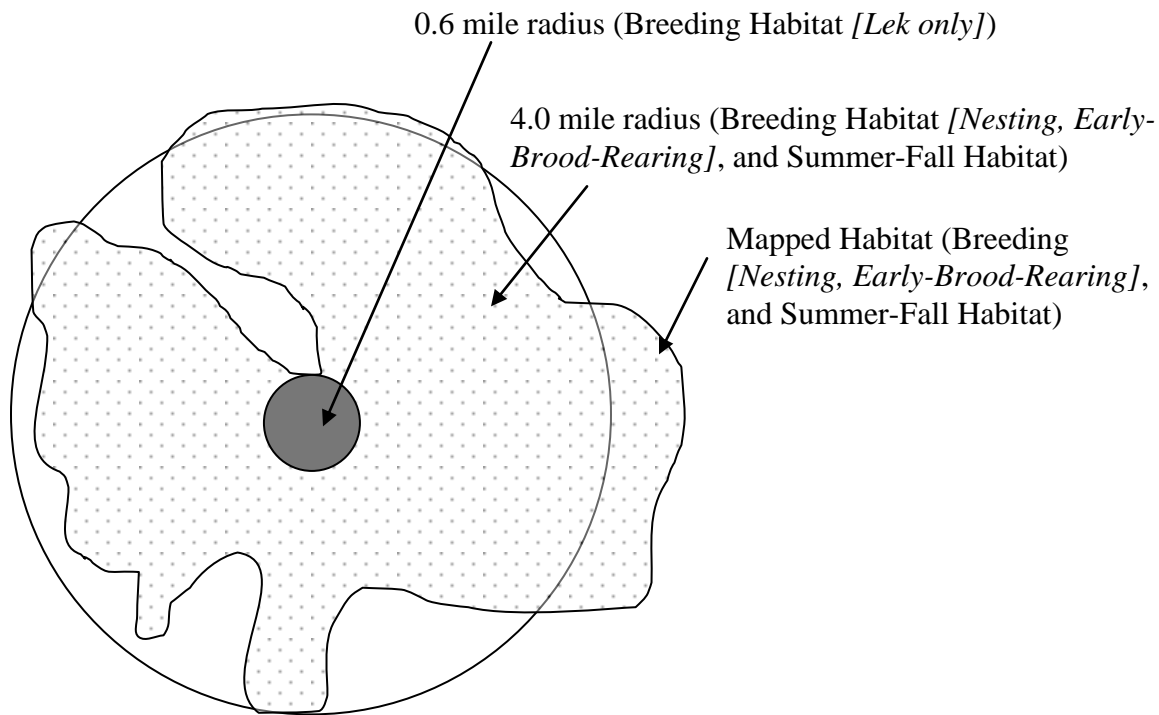


Fig. B-1. Illustration of GrSG seasonal habitat designation where habitat has been mapped, and where it is unmapped. The 2 concentric circles are to be used when seasonal habitat has not been

mapped (see text for additional explanation). The irregular polygon represents seasonal habitats that have been mapped.

Winter Habitat – If winter habitat is not delineated, then the following guidance should be used. Winter habitat is highly variable from year to year, depending upon winter conditions (especially snow depth). Because winter habitat use data is regionally specific, this plan defines winter habitat as sagebrush areas (Connelly et al. 2000c) within currently occupied habitat that (1) have sagebrush available above the snow for GrSG to use in average and extreme winters; and (2) meets the structural habitat guidelines for winter habitat in Appendix A, “GrSG Habitat Structural Guidelines”.

Mapped Seasonal Habitats

If seasonal habitats have been mapped (Fig. B-1), the following guidelines should be followed in, and relative to, the mapped habitat. If there is overlap among different seasonal mapped habitats, whichever seasonal recommendations are the most restrictive should be applied. Recognize that although suitable breeding, summer-fall, and winter habitat may fall within 4 miles of a lek, these seasonal habitats may also fall outside 4 miles due to vegetation mosaics on the landscape (e.g., Fig. B-1), and this should be considered in all management decisions. This is because GrSG can be migratory (1- or 2-stage), or non-migratory (Connelly et al. 2000c). Consult your local biologist to determine the designation of the population of concern.

Rationale for Seasonal Habitat Distance Designation (Used when Habitat is Unmapped)

There is a long history of using guidelines or stipulations within a 1/4-mile buffer around leks to protect sage-grouse from adverse impacts of human activities. We have been unable to document any scientific literature that served as the basis for the establishment of this buffer, and new data suggest that this buffer size is inadequate to prevent impacts to breeding populations (Walker et al. 2007a). The buffers we recommend for unmapped seasonal habitats (following the “History of the ‘1/4-mile Buffer’”) are based on actual data on GrSG habitat use.

History of the “1/4-mile Buffer”

Following is a description of how the 1/4-mile buffer appears to have come into use (paraphrased from a 1998 Affidavit by Dave A. Roberts, Wyoming Wildlife Program Leader, BLM, in response to Jonah oil and gas field development appeal).

“We suspect that the following is the way the 1/4 mile distance came into use, however there is no written record of how the 1/4 mile buffer was derived for use:

During the late 1950's and early 1960's, the land management agencies of the Federal government (especially the BLM and Forest Service) were doing a lot of sagebrush eradication (vegetation control) as a form of ‘range improvement’. Most biologists at the

time recognized this practice could be quite detrimental to sage grouse populations. As a result, the Western States Sage Grouse Committee was formed [in part] to address some of these impact issues. By the mid 1960's, the committee had developed some initial sagebrush management guidelines. The amount of impacts information was small at that point, however, so the initial guidelines were largely a guess [i.e., professional opinion] at what would be appropriate protection for sage grouse. The 1/4 mile distance was mutually, though not scientifically, accepted as a buffer distance from sage grouse leks to protect them from vegetation manipulations. Several editions of the guidelines were created from their initiation in the mid 1960's until their final publication in *The Wildlife Society Bulletin* in 1977. The 1/4 mile distance apparently dropped out somewhere along the way, or simply was never adopted in the published guidelines.

The BLM started using the 1/4 mile distance, for lack of anything better, along with the rest of the published guidelines, back in the late 1960's. Over a period of time (now, over 3 decades) the 1/4 mile distance just evolved into a de facto 'guideline', or standard, through routine, everyday usage, even though there was not any real, empirical, scientific evidence to either support or refute its usage. Some more recent (within the last 5-8 years) studies and anecdotal observations would suggest that a greater distance (possibly 1/2 mile) would be a more appropriate protective buffer around sage grouse leks. Even these more recent studies, however, have not really been designed to empirically ascertain an appropriate setback distance.”

The lack of supporting data for the 1/4-mile buffer is evident. We have used recent data from multiple studies to derive alternative buffers, for use when GrSG habitats have not been mapped.

Breeding Habitat (March through July)

Lek Habitat (March through mid-May) - The basis and rationale for the first radius, 0.6 miles from a lek (Fig. B-1), is developed by summarizing data from 5 separate studies of daytime movements of adult male sage-grouse during the breeding season (Carr 1967, Wallestad and Schladweiler 1974, Rothenmaier 1979, Emmons 1980, Schoenberg 1982), because daytime movements of adult male GrSG during the breeding season do not vary greatly. Wallestad and Schladweiler (1974) found daily movements of adult males ranged between 0.2 and 0.8 miles from leks, with a maximum cruising radius of 0.9 - 1.2 miles. Ellis et al. (1987) reported that dispersal flights of male GrSG (to day-use areas) ranged from 0.3 – 0.5 miles, with the longest flights ranging from 1.2 – 1.3 miles. Carr (1967) recorded a cruising radius for male GrSG that ranged from 0.9-1.1 miles. Rothenmaier (1979) found that 60-80% of male GrSG locations were within 0.6 - 0.7 miles of a lek. Emmons (1980) reported that male dispersal distances to day-use areas of 0.1 miles were common and that 67% of all use areas were greater than 0.3 miles from the lek. In addition, Schoenberg (1982) found that male daily movements averaged 0.6 miles, but ranged from 0.02 - 1.5 miles.

Male GrSG activity patterns during the breeding season include strutting during the early morning hours, feeding and loafing during the day, and roosting on the lek during the night. Grouse attending the lek do not always roost on the exact location where the strutting occurs the

next morning. Occasionally (this is lek-dependent), grouse roost in adjacent sagebrush cover. Ultimately, male GrSG require an open area for strutting, and sagebrush immediately adjacent for feeding and loafing. Sagebrush adjacent to the lek is also used as escape cover from predators or other types of disturbance. Female GrSG that attend the lek also use the area in this zone in the same fashion as do males (Patterson 1952, Barnett and Crawford 1994, Coggins 1998).

Nesting (April through June) and Early Brood-Rearing Habitat (mid-May through July) - The second circle (Fig. B-1) encompasses nesting and early-brood-rearing habitat, and includes habitat within 4.0 miles from the lek. This is based on 6 research projects from Colorado, Idaho, and Wyoming (Peterson 1980; Autenrieth 1981; Giesen 1995; Holloran and Anderson 2005; A.D. Apa, CDOW, unpublished data). Data from these studies indicate that for 1,164 nests located by radio-telemetry, 79.0% of nests (n = 920/1,164; Table B-1) were located within 4 miles of the active lek where the females were captured.

The 4-mile radius differs from breeding habitat designations in previously published guidelines. Braun et al. (1977) considered the breeding complex to be within a 1.9-mile radius of an occupied lek, although in some circumstances they suggested that the breeding complex could exceed this distance. The 1.9-mile radius was based upon 2 research studies in which nests were located by ground-searching a 2-mile radius from active leks (Gill 1965, Martin 1970), and upon 2 radio-telemetry studies (Wallestad and Pyrah 1974, Autenrieth 1981). Later, Connelly et al. (2000c) suggested that breeding habitat exists within 2.0 miles of occupied leks when the habitat is uniform and the population is non-migratory. In addition, Connelly et al. (2000c) further recommended that breeding habitat should be protected within 3.1 miles of an occupied lek in non-uniform habitat where the population is non-migratory. In migratory populations, breeding habitat can occur up to 11.2 miles from occupied leks (Connelly et al. 2000c).

Previously, a 2-mile radius was thought to protect 80% of GrSG nesting habitat. Only 52% of the sample we used from multiple states (n = 605/1,164; Table B-1) would have been located within breeding habitat as identified by a 2-mile radius. Data from strictly Colorado GrSG populations follow a similar pattern. Of Colorado research summarized to date (based on data from telemetered GrSG females in Colorado), 52% of females (n = 271/518) nest within 2 miles of the lek they were captured on, while 80.5% (n = 417/518) nest within 4 miles of the lek upon which they were captured (Table B-1). The 2-mile radius is inadequate because it only protects approximately 50% of nests, whereas a 4-mile radius protects 80% of nests. Identifying the 4.0-mile radius circle is a good example of the continuous adaptive process of using more recent and local data to update guidelines, and to make them more appropriate for local situations. As mentioned earlier, the 4.0-mile radius is intended to be used only when breeding habitat has not been mapped.

Summer–Fall (July through September) and Winter Habitat (October through February)

Summer–Fall Habitat (July through September) - In general, all sagebrush stands within a 4-mile radius of an active lek can be considered sage-grouse habitat, although summer-fall habitat can

also include riparian areas and agricultural fields within this radius. As sagebrush communities continue to dry out and many forbs complete their life cycles, sage-grouse typically respond by moving to a greater variety of habitats, and generally more mesic habitats (Patterson 1952). Sage-grouse begin movements in late June and into early July (Gill 1965, Klebenow 1969, Savage 1969, Connelly and Markham 1983, Gates 1983, Connelly et al. 1988, Fischer 1994). By late summer and into the early fall, females with broods, non-brood females, and groups of males become more social, and flocks are more concentrated (Patterson 1952). This is the period of time when GrSG can be observed in atypical habitat such as farmland and irrigated habitats (Connelly and Markham 1983, Gates 1983, Connelly et al. 1988).

From mid-September into October, GrSG prefer areas with more dense sagebrush (>15% canopy cover) and late green succulent forbs before moving to early transitional winter range where sexual segregation of flocks becomes notable (Wallestad 1975, Beck 1977, Connelly et al. 1988). During periods of heavy snow cover in late fall and early winter, use of mountain and Wyoming big sagebrush stands is extensive.

Winter Habitat (October through February) - GrSG winter habitat use depends upon snow depth and availability of sagebrush, which is used almost exclusively for both food and cover. Used sites are typically characterized by canopy cover >25% and sagebrush >12-16 inches tall (Schoenberg 1982), and are associated with drainages, ridges, or southwest aspects with slopes < 15% (Gill 1965, Wallestad 1975, Beck 1977, Robertson 1991). In Colorado, <10% of sagebrush habitat is used by GrSG during deep snow conditions (Beck 1977) because most of the sagebrush is buried under the snow. When snow deeper than 12 inches covers over 80% of the winter range, GrSG in Idaho have been shown to rely on sagebrush greater than 16 inches in height for foraging (Robertson 1991). Doherty et al. (2008) found that females preferred landscapes with extensive sagebrush habitat and gentle to flat terrain, and avoided areas with conifers, woody riparian zones, and rough terrain. Females also avoided areas with coal-bed natural gas development, and were 30% less likely to use an area with coal-bed natural gas development even if it contained suitable habitat.

Lower flat areas and shorter sagebrush along ridge tops provide roosting and feeding areas. During extreme winter conditions, GrSG will spend nights and portions of the day (when not foraging) burrowed into “snow roosts” (Back et al. 1987). When snow has the proper texture, snow roosts are dug by wing movements or by scratching with the feet.

Hupp and Braun (1989b) found that most GuSG feeding activity during the winter occurred in drainages and on slopes with south or west aspects in the Gunnison Basin. In years with severe winters resulting in heavy accumulations of snow, the amount of sagebrush exposed above the snow can be severely limited. Hupp and Braun (1989b) investigated GuSG feeding activity during a severe winter in the Gunnison Basin in 1984, where they estimated <10% of the sagebrush was exposed above the snow and available to sage-grouse. In these conditions, the tall and vigorous sagebrush typical in drainages were an especially important food source for GuSG.

Colorado GrSG Disturbance Guidelines

Whether seasonal habitats are unmapped or mapped, if there is overlap among the designated different seasonal habitats, whichever seasonal recommendations are the most restrictive should be applied.

Habitat Disturbance

In the course of all of the following activities, when seasonal habitats overlap, if possible, efforts should be made to avoid activities during the designated time periods. If not possible, then conduct the activities during the summer-fall period when grouse are more mobile and less energy is expended (versus, e.g., winter and nesting periods) so they can move and could avoid any activities. Generally speaking, the following timelines apply throughout the year for GrSG biology requisites in these habitats:

- Breeding Habitat (March through July)
 - Lek Habitat (March through mid-May)*
 - Nesting Habitat (April through June)*
 - Early-Brood Rearing Habitat (mid-May through July)*
- Summer-Fall Habitat (July through September)
- Winter Habitat (October through February)

In all cases discuss the timelines on site-specific cases with a local biologist.

Breeding Habitat – *Lek Habitat*

- a. Sagebrush Alteration – Any sagebrush manipulation should be extremely limited or prohibited within 0.60 mi of an active lek. Exceptions include sagebrush manipulations that are conducted to reduce shrub or vegetation height and density to improve the character of the actual lek.
- b. Anthropogenic Features (also consult “a. Sagebrush Alteration” above, if feature construction will result in removal of any sagebrush):
 1. Short-term (≤ 1 year) – Restore lek habitat to the original sagebrush community (according to site capability; see Winward 2004, Monsen 2005, and Appendix A, “GrSG Structural Habitat Guidelines”), following feature removal.
 2. Long-term (> 1 year) – Anthropogenic features are strongly discouraged due to the long-term loss of lek habitat (if unavoidable, minimize the footprint (area disturbed by feature construction) and see “Functional Bird Disturbance”).

Breeding Habitat – *Nesting and Early-Brood-Rearing Habitat*

- a. Sagebrush Alteration
 1. Uniform and Unfragmented Breeding Habitat - sagebrush removal and/or treatment projects should be limited and not exceed 20-30% (Connelly et al. 2000c) of the total mapped habitat. Treatments need

recovery objectives that achieve the structural habitat guidelines identified in this plan (according to site capability; see Winward 2004, Monsen 2005, “Habitat Enhancement” strategy [pg. 349], and Appendix A, “GrSG Structural Habitat Guidelines”). Treatment blocks should be small (< 50 acres) and interspersed across the landscape in irregular configurations and shapes. Treated areas should not be systematic or predictable (e.g., a ratio of treated to untreated strips) across the landscape.

2. Fragmented Breeding Habitat – If the mapped original breeding habitat area has >40% loss (Connelly et al. 2000c) to other factors, all remaining habitat should be protected from disturbance.
- b. Anthropogenic Features (also consult “a. Sagebrush Alteration” above, if feature construction will result in removal of any sagebrush). These include any human-made structures or features that are present on the landscape for 1 year or less (short-term) and greater than 1 year (long-term).
1. Short-term (\leq 1 year; e.g., fire-fighting camps, temporary corrals) – Restore nesting and early-brood-rearing habitat to the original sagebrush community (according to site capability; see Winward 2004, Monsen 2005, and Appendix A, “GrSG Structural Habitat Guidelines”), following feature removal.
 2. Long-term ($>$ 1 year) – Anthropogenic features should be limited if possible, due to the long-term loss of nesting and early-brood-rearing habitat (if unavoidable, minimize the footprint and see “Functional Bird Disturbance”).

Summer–Fall Habitat

- a. Sagebrush Alteration
 1. Maintain sagebrush communities (Hausleitner 2003) within 0.20 miles (Connelly et al. 2000c) of known or suspected brood foraging areas. Sagebrush manipulations must be carefully planned to achieve the structural habitat guidelines (according to site capability; see Winward 2004, Monsen 2005, “Habitat Enhancement” strategy [pg. 349], and Appendix A, “GrSG Structural Habitat Guidelines”).
- b. Anthropogenic Features (also consult “a. Sagebrush Manipulation” above, if feature construction will result in removal of any sagebrush)
 1. Short-term (\leq 1 year) – Restore summer-fall habitat to the original sagebrush community (Winward 2004, Monsen 2005) following feature removal.
 2. Long-term ($>$ 1 year) – Anthropogenic features should be limited if possible, due to the long-term loss of summer-fall habitat (if unavoidable, minimize the footprint and see “Functional Bird Disturbance”).

Winter Habitat

- a. Sagebrush Alteration
 1. Sagebrush manipulations need to be limited or prohibited in winter habitat. Any manipulations should be small (< 10 acres) in size and not exceed 20% (Connelly et al. 2000c) of the delineated winter

habitat. Treatments should be irregular in shape and not predictable or systematic (e.g., ratio of treated and untreated strips) on the landscape. Treatments in the shape of rows or strips should be avoided.

- b. Anthropogenic Features (also consult “a. Sagebrush Manipulation” above, if feature construction will result in removal of any sagebrush)
 1. Short-term (< 1 year) – Restore winter habitat to the original sagebrush community (according to site capability; see Winward 2004, Monsen 2005, and Appendix A, “GrSG Structural Habitat Guidelines”), following feature removal.
 2. Long-term (> 1 year) – Anthropogenic features should be limited if possible, due to the long-term loss of winter habitat (if unavoidable, minimize the footprint and see “Functional Bird Disturbance”).

Functional Bird Disturbance

In the course of all of the following activities, when seasonal habitats overlap, if possible, efforts should be made to avoid activities during the designated time periods. If not possible, then conduct the activities during the summer-fall period when grouse are more mobile and less energy is expended (versus, e.g., winter and nesting periods) so they can move and could avoid any activities. Generally speaking, the following timelines apply throughout the year for GrSG biology requisites in these habitats:

- Breeding Habitat (March through July)
 - Lek Habitat (March through mid-May)*
 - Nesting Habitat (April through June)*
 - Early-Brood Rearing Habitat (mid-May through July)*
- Summer-Fall Habitat (July through September)
- Winter Habitat (October through February)

In all cases discuss the timelines on site-specific cases with a local biologist.

Breeding Habitat – *Lek Habitat*: Any activities associated with the following anthropogenic features, or any other bird-disturbing activities, should be limited between sunset and 2 hours after sunrise (modified from Lyon and Anderson 2003, A.D. Apa, CDOW, personal communication). There should be complete exclusions or significant restrictions from 2 hours before sunrise to 2 hours after sunrise during this time of year.

1. Anthropogenic Features or Human Activities

- a. Fences – Any fences planned within 0.60 miles of an active lek should be avoided whenever possible, but if avoidance is not possible, fences should be retro-fitted with devices that increase their visibility in areas of suspected or confirmed grouse collision mortalities. This effort is an attempt to reduce potential grouse collisions. Similar devices should be applied to existing fences in areas of suspected or confirmed collisions. In addition to visual devices, where possible, place fences in areas where topographic features can be used that will deter collisions (e.g., not on ridges).
- b. Powerlines (transmission, service lines) – Whenever possible, avoid the construction of powerlines in lek habitat. If impractical, powerlines within lek habitat should be retro-fitted to deter raptor perching. If practical, powerlines should be constructed to reduce the likelihood of grouse-wire collisions. Similar adjustments should be applied to existing powerlines where grouse mortality issues have been identified.
- c. Oil and Gas Exploration and Production – These anthropogenic features should not be constructed within lek habitat. If unavoidable, all activities should have minimal noise. Compressors, vehicles and other sources of noise should be equipped with effective mufflers or noise suppression to make the sounds emanating from these devices as

- quiet as technologically possible. As a guideline, grouse vocalizations are less than 20 dBA (Dantzker et al. 1999).
- d. Roads and Trails – Avoid constructing roads and trails within lek habitat. If unavoidable, roads should be placed so they, and their associated traffic, are not in direct line-of-sight of strutting males. Vehicles should not exceed 30 - 40 mph (adapted from Tessman et al. 2004) during the strutting period to avoid grouse-vehicle collisions. Roads should be minimally developed and seasonal closures should be developed.
 - e. Ex-urban Housing Development – No housing developments should occur within lek habitat.
 - f. Wind Power Generation and Communication Tower Sites – These sites should not be constructed within lek habitat.
 - g. Recreational Activities – Recreational activities should be excluded or strictly coordinated to accommodate the aforementioned timeframes. Lek viewing opportunities should be strictly controlled and emphasized during time periods before and after peak female attendance and breeding to avoid interrupting breeding activities. Once protocols are produced, lek viewing protocols should be monitored for compliance.
 - h. Herbivory – In situations where animals can be controlled (i.e., domestic sheep beds), avoid bedding sheep on or within 100 feet of active leks during the strutting period. Numerous anecdotal observations have documented sheep being bedded directly on lek and male and female GrSG fail to roost on the leks. Male display activity and roosting on leks is dramatically reduced or not present (A.D. Apa, CDOW, personal communication).
 - i. Research Activities – Research and management activities that could have detrimental impacts to individuals or populations must have Animal Care and Use Committee approval as well as the appropriate trapping and handling permits issued by CDOW. In addition, ethical handling guidelines will be in conformance with Gaunt and Oring (1997).
 - j. Surface Mining or Similar Activities – These anthropogenic features should not be constructed within lek habitat. If unavoidable, all activities should have minimal noise. Compressors, vehicles and other sources of noise should be equipped with effective mufflers or noise suppression to make the sounds emanating from these devices as quiet as technologically possible. As a guideline, grouse vocalizations are less than 20 dBA (Dantzker et al. 1999).

Breeding Habitat – *Nesting and Early-Brood-Rearing Habitat*,
Summer-Fall Habitat, and
Winter Habitat

1. Anthropogenic Features or Human Activities

- a. Fences - If, in the course of other activities, it is determined that fences in a particular area in these seasonal habitats are causing collisions, avoid constructing new fences in that area, and/or move, and/or retrofit existing fences to increase visibility and decrease possibility of collisions.
- b. Powerlines - If possible, powerlines should be avoided in these seasonal habitats. If not possible, consider burying powerlines, placing raptor perching deterrents, and avoiding areas where sage-grouse concentrate, riparian areas, or areas where collisions or predatory events from perching raptors have been documented.
- c. Oil and Gas Exploration and Production – Any necessary equipment should produce minimal noise; all compressors, vehicles, and other sources of noise should be equipped with effective mufflers or noise suppression devices to provide the quietest conditions technologically possible. Encourage remote monitoring to minimize disturbance of grouse during this period.
- d. Roads and Trails – Local (generally, unpaved) roads and trails should be excluded when possible, and when not, road and trail length and width should be minimized to the extent possible. Vehicles should not exceed 30 - 40 mph (adapted from Tessman et al. 2004) on local or unpaved roads.
- e. Ex-urban Housing Development - Housing developments should be discouraged in all GrSG habitats. When this is not practical, houses should be clustered as much as possible and domestic pets should be controlled to reduce predation or harassing events.
- f. Wind Power Generation and Communication Tower Sites – These sites should be avoided if possible. If not possible, retrofit all aspects of turbines and towers to deter raptor perching, and to decrease the possibility of GrSG collisions in identified or potential collision areas.
- g. Recreational Activities – Recreational activities should be localized and confine activities to established and approved roads and trails. In winter habitat, activities should be dramatically reduced in documented winter habitat.
- h. Surface Mining or Similar Activities – Any necessary equipment should produce minimal noise; all compressors, vehicles, and other sources of noise should be equipped with effective mufflers or noise suppression devices to provide the quietest conditions technologically possible. Encourage remote monitoring to minimize disturbance of grouse during this period.

Table B-1. Data and recommendations regarding GrSG nest location and delineation of GrSG breeding habitat.

DATA: DISTANCE OF GrSG NESTS FROM LEK OF CAPTURE				
% Nests within 2-mi. radius	% Nests Within 4-mi. radius	Telemetry Research	Location	Study
86.9 (n = 20/23)	N/A	No – ground searches for nests	North Park, CO	(A) Gill (1965)
80.0 (n = 4/5)	N/A	No – ground searches for nests	Montana	(B) Martin (1970)
59.5 (n = 182/306)	85 (n = 260/306)	Yes	Idaho	(C) Autenrieth (1981)
46.4 (n = 13/28)	85.7 (n = 24/28)	Yes – estimates made from a Figure in thesis	North Park, CO	(D) Peterson (1980)
71.8 (n = 51/71)	90.1 (n = 64/71)	Yes	North Park, CO	(E) Giesen (1995)
49.5 (n = 192/388)	77.1 (n = 299/388)	Yes	Moffat County, CO	(F) Thompson et al. 2005, Thompson 2006
48.4 (n = 15/31)	96.8 (n = 30/31)	Yes	Eagle and South Routt Counties, CO	(G) Graham and McConnell 2004, Graham and Jones 2005
44.7 (n = 152/340)	74.4 (n = 243/340)	Yes	Wyoming	(H) Holloran and Anderson (2005)
SUMMARIES OF DATA SETS				
52.3 (n = 271/518)	80.5 (n = 417/518)	Yes	All CO studies since 1980	(D) - (G)
52.0 (n = 605/1,164)	79.0 (n = 920/1,164)	Yes	All telemetry studies outlined in this table (CO, WY)	(C) - (H)
RECOMMENDATIONS:				
Connelly et al. (2000c) Guidelines for delineation GrSG breeding habitat if no local information is available				
Population Type	Habitat Uniform?	Distance from Lek		
Non-migratory	Uniform sagebrush habitat	≤ 2 mi		
Non-Migratory	Non-uniform sagebrush habitat	≤ 3.1 mi		
Migratory	No designation	≤ 11.2 mi		

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