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May 1, 2014

Mr. Neil Kornze, Director
Bureau of Land Management
U.S. Department of the Interior
1849 C Street NW, Room 5665
Washington DC 20240

Dear Mr. Kornze:

The Pew Charitable Trusts encloses our consolidated technical comments on the Bureau of Land Management's (BLM) 15 greater sage-grouse draft environmental impact statements (DEIS). Pew bases our comments on the BLM's National Technical Team report and other best available science that is cited in the comments. We commend the BLM for the impressive level of work reflected in these DEISs.

Significant improvements are, however, needed across these plans. The plans need to be strengthened and made more consistent with one another across planning area boundaries. We believe that BLM can be successful with this effort and provide solid, proactive protections for sage-grouse that will also benefit other wildlife across the sage-steppe ecosystems of the interior West.

The Pew Charitable Trusts appreciates this opportunity to provide science-based comments for the agency's consideration in preparing final plans. We look forward to our continued engagement in this issue and make ourselves available to discuss the contents of this report or other matters regarding the conservation of the greater sage-grouse.

Sincerely,

Ken Rait

Ken Rait
Director, U.S. Public Lands
The Pew Charitable Trusts

Cc: Sarah Greenberger, Senior Advisor, Office of the Secretary, Department of the Interior
Jim Lyons, Counselor to the Assistant Secretary, Land and Minerals Management, Department of the Interior
Steven Ellis, Deputy Director for Operations, Bureau of Land Management
Edwin Roberson, Assistant Director, Renewable Resources and Planning Directorate, Land and Minerals Management, Department of the Interior

Consolidated Technical Comments
Regarding the Bureau of Land Management's
Greater Sage-grouse
Draft Environmental Impact Statements

Submitted by The Pew Charitable Trusts
May 1st, 2014

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Introduction

We are pleased to provide these technical comments regarding the Bureau of Land Management's (BLM) 15 draft environmental impact statements (DEISs) that will amend resource management plans across the West to conserve the greater sage-grouse.

Below we present a review of the literature where the actions stipulated in the preferred alternative for each DEIS differed from the alternative most closely aligned with the BLM's National Technical Team report (NTT report) or where the literature did not support the stipulations forwarded in either alternative. We provide management recommendations for consideration that are based on the best-available science.

First we would like to acknowledge that while improvements should be made, the management actions stipulated in many of the DEISs' preferred alternatives represent a significant advance in how sagebrush habitats are managed not only for the conservation of sage-grouse but for all wildlife reliant on these ecosystems. The BLM should be commended for the impressive level of work reflected in these DEISs. The dedication required to complete the work is apparent in the documents reviewed.

The most notable and overriding concern that surfaced from reviewing the DEISs was the lack of consistency among the management actions proposed throughout the preferred alternatives. Although the actual habitat attributes important for the species are in many instances region-specific, the plans would benefit from consistently applied actions for the larger-scale management concerns, such as the approaches to energy development, anthropogenic infrastructure, West Nile virus, and mitigation. Sage-grouse are considered a landscape-scale species. Populations generally inhabit and rely on large, interconnected expanses of sagebrush. Therefore, sage-grouse management planning should aim to provide these populations with large, functional, connected habitat patches across landscapes. Inconsistencies across jurisdictional boundaries may lead to a failure to address the landscape needs of the species. We do not believe the draft BLM plans accomplish this fundamental goal and thus need to be made not just more consistent, but significantly strengthened, before they are finalized.

Although forming generalized comments on specifics included in the DEISs is problematic, given the lack of consistency, some relatively consistent deviations from literature were noted in the review. Prescribed fire remains a management option under the preferred alternative in many of the DEISs, despite substantial published research suggesting that fire in xeric sagebrush habitats is detrimental to these habitats and the sage-grouse populations reliant upon them. Most of the DEISs address anthropogenic infrastructure densities, but few directly address distance-effects associated with these infrastructures. Concurrently applied approaches to limiting infrastructure densities, ensuring that indirect effects of infrastructure are minimized, and reducing human activity levels within important seasonal habitats are supported by research. Many of the DEISs do not include sage-grouse-specific metrics and indicators when assessing livestock management needs, relying instead on rangeland health standards. Habitat indicators specific to sage-grouse are important because it is possible to successfully manage a site for long-term stability within the reference vegetative community but fail to achieve sage-grouse habitat objectives. A combination of management toward long-term plant species composition and growth and short-term standing crop to provide residual herbaceous cover for sage-grouse is required. Finally, most of the DEISs included language alluding to “effective mitigation” or “only treatments that conserve, enhance or restore sage-grouse habitat be allowed.” Although discussed at length in individual DEIS reviews, it is worth highlighting here that tremendous uncertainty exists about the vegetative and sage-grouse population outcomes of habitat treatments. Extreme caution and discretion need to be employed when proposing habitat treatments, especially in Wyoming’s big sagebrush-dominated and other xeric-sagebrush habitats. This is not to say efforts should not be initiated to address habitat degradation, because habitat degradation is a significant causal factor in sage-grouse declines across the range of the species. However, a conservative approach to proactive habitat manipulations is warranted due to a lack of current understanding regarding the effectiveness of management actions that consistently improve sagebrush habitat conditions for sage-grouse.

The Pew Charitable Trusts appreciates this opportunity to provide science-based comments for the agency’s consideration in preparing final plans. We look forward to our continued engagement in this issue and make ourselves available to discuss the contents of this report or other matters regarding the conservation of the greater sage-grouse.

Northwest Colorado Greater Sage-Grouse Draft RMP Amendment/EIS

Fluid Minerals—Unleased

Summary of DEIS for Fluid Minerals—Unleased

The preferred alternative allows for fluid mineral leasing in Preliminary Priority Habitat (PPH), but with a No Surface Occupancy (NSO) stipulation. Essentially, under the preferred alternative, fluid minerals can be leased in PPH but must be accessed from infrastructure placed outside of PPH boundaries. The preferred alternative differs from Alternative B—the alternative in the DEIS aligned with the recommendations forwarded in the NTT report—in that Alternative B closes PPH to fluid mineral leasing. Both alternatives allow for infrastructure required to develop unleased fluid mineral resources to be placed outside the boundaries of PPH, with the preferred alternative stipulating a 0.6-mile NSO around active leks and a 4-mile NSO around active leks during lekking, nesting, and early brood-rearing seasons in All Designated Habitats (ADH, which include PPH, Preliminary General Habitats (PGH), and linkage areas). PPH was designated as areas of high probability of sage-grouse occurrence, as estimated from breeding, summer, or winter models presented by Rice et al. (2013), within 4 miles of leks that have been active within the last 10 years.

Analysis of Fluid Minerals—Unleased

Other than the NSO and seasonal timing restriction actions forwarded under the preferred alternative, the indirect effects of infrastructure on sage-grouse were not addressed by either the preferred alternative or Alternative B. This may be important in situations where infrastructure is placed outside of a PPH but within close proximity to the PPH boundary. Several authors have reported a “distance-effect” associated with the infrastructure of oil and gas fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts to lekking sage-grouse of well pads located nearer leks were more consistently observed across energy fields compared to well pads farther away, with a consistent pattern whereby the presence of well pads within smaller-radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek-persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development to the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species.

Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within

950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

Research relevant to the efficacy of the 0.6-mile NSO is not available. However, leks that had at least one well pad within 0.4 km had 35-92% fewer sage-grouse, compared to leks with no well pads within this radii (Harju et al. 2010). Walker et al. (2007) reported that implementing a 0.4-km NSO given full field development within the remainder of a 0.8-km- or 3.2-km-radius area would result in lek-persistence probabilities of 5% and 24%, respectively.

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse during the winter avoiding the infrastructure of a gas field during the day but not at night, suggesting that avoidance was of human activity rather than the infrastructure itself. This would suggest timing restrictions may be effective at least during the winter if human activity at infrastructure in or near winter ranges is eliminated or minimized.

Recommendation for Fluid Minerals—Unleased

- **Maintain the preferred alternative stipulations for fluid mineral development in PPH, which are supported by the scientific literature.** However, modifications to the boundaries delineated by the 4-mile buffer may have resulted in PPH boundaries being relatively close to leks and/or other seasonal habitats. Additionally, the use of probability of occurrence layers to designate PPH within 4 miles of active leks may result in patches of habitat within 4 miles of leks being designated as Preliminary General Habitat (PGH).
- **Include all areas, regardless of habitat designation, within 2-4 km of a lek as NSO for lower activity sites (e.g., producing well pads) and all areas within 6-6.4 km of a lek NSO for higher activity sites (e.g., drilling rigs). Additionally consider restricting fluid mineral development in all areas, regardless of habitat designation, within 2 km of winter range and within 1 km of nesting habitats.** These suggestions are in addition to the NSO stipulation forwarded in the preferred alternative. Alternative B does not provide language analogous to these suggestions. Additionally, if the goal of the 0.6-mile NSO in ADH is to minimize negative impacts of energy development on sage-grouse populations (rather than, for example, maintaining lekking habitat integrity), current research supports the NSO buffers recommended in boldface above**.** While the 0.6-mile NSO may be sufficient to protect the habitats used by male sage-grouse during the breeding season, a buffer this small will not eliminate indirect effects of energy development.

- **Minimize human activity at infrastructure placed within seasonally protected areas.** Although seasonal timing restrictions are stipulated in the preferred alternative, recommendations forwarded in the literature as well as the NTT report suggest seasonal timing restrictions are ineffective, especially given that in this plan, timing restrictions do not apply to operation and maintenance of production facilities. For example, Appendix I ("Required Design Features, Preferred Design Features, and Suggested Design Features") lists the following as Preferred Design Features (PDFs) for fluid mineral development under the preferred alternative: "establish trip restrictions or minimization through use of telemetry and remote well control" and "place liquid gathering facilities outside of priority areas." Requiring these practices when developing fluid minerals in priority areas could reduce human activity levels in these areas.

Fluid Minerals—Leased

Summary of DEIS for Fluid Minerals—Leased

The preferred alternative establishes that surface disturbance within ecological sites that support sagebrush in PPH will not exceed 5% in any Colorado management zone. Additionally, seasonal timing restrictions within 4 miles of active leks in PPH that preclude activities during lekking, nesting, and early brood-rearing will be implemented for development of existing leases. Seasonal timing restrictions will also be implemented for geophysical exploration and exploratory drilling in leased PPH. This differs from Alternative B, which establishes that surface disturbance in leased PPH will not exceed 3% in any Colorado management zone and that surface disturbance in PPH will not exceed one per section (square mile) and 3% of area per section. The preferred alternative establishes that unitization will be encouraged in PPH when deemed necessary. The preferred alternative also establishes that, where applicable and technically feasible, PDFs should be applied as mandatory Conditions of Approval (COA) when developing leases in PPH. These differ from Alternative B in that Alternative B would require unitization when deemed necessary, and would implement Required Design Features (RDFs). ADH is broken into 21 Colorado management zones as described in the DEIS (Table 1.1 and Figure 1-1). Unitization provides for the exploration, development, and operation of a geologically defined area by a single operator, making phased and/or clustered development more tenable.

Analysis of Fluid Minerals—Leased

Substantial amounts of research are available suggesting that reducing infrastructure densities around leks will benefit sage-grouse. However no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Harju et al. (2010) reported that common well pad densities of four and eight pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below 1 pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding one well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (8 pads/section).

Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the "developed" covariate examined included urban and suburban areas, and interstate and state highways, as classified by Landfire (2006), and was quantified within 1-km grid cells. Therefore, the results may not be comparable to how the stipulations in the DEIS are forwarded.

Unitization may benefit sage-grouse by resulting in the co-location or clustering of infrastructure of energy development. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al. (2007) found that gas development—measured as the proportion of area around a lek within 350 m of the infrastructure of a gas field—within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities.

Recommendation for Fluid Minerals—Leased

- **Minimize energy development infrastructure densities to 1 per section averaged across an area designated by a 3- to 3.2-km radius as supported by research. Despite the lack of scientific evidence supporting a consistently applied surface disturbance threshold, Alternative B is generally supported by the literature because of its requirement for unitization and RDFs.**
- **Require the surface disturbance threshold to be established as the proportion of area disturbed by a metric that can be directly related to infrastructure density** if a surface disturbance threshold is to be applied. For example, one average-size well pad and access road directly influences a given number of acres that can be divided by 640 to establish a surface disturbance threshold that is directly relevant to the density threshold of one well pad/section reported in the literature. Research suggests that the co-location or clustering of infrastructure reduces impacts of energy development on sage-grouse by reducing the proportion of a landscape indirectly influenced by that infrastructure. Thus, **surface disturbance thresholds should be calculated across a larger area than 1 mi^2 to allow for clustering of infrastructure while maintaining the average one pad/section and surface disturbance threshold**.

- **Reconcile the potential contradiction between a per-section surface disturbance threshold and unitization that clusters infrastructure in smaller areas**. The potential benefits of unitization (i.e., the co-location or clustering infrastructure of energy developments in PPH—also presented as an RDF/PDF below) may be incompatible with the per-section surface disturbance thresholds as forwarded in Alternative B, where permitted disturbances are limited to "one per section with no more than 3% surface disturbance in that section." Limiting disturbance to one well pad/infrastructure and 3% surface disturbance per section as established in Alternative B, unless quantified as an average across a larger landscape, will counteract and contradict the requirement of clustering infrastructure.

Summary of RDFs Contained Within Fluid Minerals—Leased

Research suggests that sage-grouse may benefit from some of the design features listed in the DEIS being RDFs instead of PDFs as designated in the preferred alternative. RDFs are those required for a specified proposal or project; PDFs are established guidelines followed by the BLM/U.S. Forest Service to be incorporated into management activities where necessary, appropriate, and/or technically feasible. It is worth noting that RDFs and PDFs appear to be used interchangeably in the DEIS. However, in Appendix I ("Required Design Features, Preferred Design Features, and Suggested Design Features, Regional Mitigation Strategy"), the preferred alternative specifically designates the following as PDFs, while Alternative B specifically designates them as RDFs. Design features include:

1. Build and maintain water disposal ponds to reduce breeding and larval habitats for *Cx. tarsalis* mosquitoes in ADH.
2. Restrict speeds on roads and reduce frequency of use on roads in energy developments in PPH.
3. Co-locate or cluster infrastructure of energy developments in PPH.
4. Place utilities (power lines, pipelines, etc.) in existing utility or transportation corridors, and bury distribution power lines in PPH.
5. Discourage nesting of raptors and corvids on aboveground facilities and clean up refuse to reduce corvid presence in energy fields in PPH.
6. Limit noise to <10 decibels above ambient measures at the perimeter of leks during breeding season in PPH.
7. Locate "man camps" outside of PPH.
8. Remove trees within 100 m of occupied greater sage-grouse leks and other seasonal habitats in ADH. Each of these design features are discussed in further detail below:

Analysis of RDF/PDF #1: Build and maintain water disposal ponds to reduce breeding and larval habitats for *Cx. tarsalis* mosquitoes in ADH

Presently, sage-grouse lack resistance to West Nile virus (WNv), and exposure to the virus results in 100% mortality (Clark et al. 2006). It is worth noting that given relationships among temperature, water, and WNv, climate change is resulting in higher temperatures and drier summer conditions in the western United States as most models predict that impacts of WNv on sage-grouse populations may increase.

Recommendation for RDF/PDF #1: Build and maintain water disposal ponds to reduce breeding and larval habitats for *Cx. tarsalis* mosquitoes in ADH

- **Require—as presented in Alternative B—that water disposal ponds associated with energy developments and stock ponds are built and maintained to reduce larval habitats for *Cx. tarsalis* mosquitoes**.

Analysis of RDF/PDF #2: Restrict speeds on roads and reduce frequency of use on roads in energy developments in PPH

Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a five-year period; traffic speed was not measured, but the potential for increased speed was inferred from the upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes. Additionally, vehicle activity on roads within 3 km of leks during the time of day sage-grouse were present on leks influenced the number of males on leks more negatively than leks where roads within 3 km had no vehicle activity during the strutting period. Lyon and Anderson (2003) reported that traffic disturbance (one to 12 vehicles/day) within 3 km of leks during the breeding season reduced nest-initiation rates and increased distances moved from leks during nest site selection of female sage-grouse breeding on those leks. Blickley et al. (2012) reported that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise from a drilling rig.

Recommendation for RDF/PDF #2: Restrict speeds on roads and reduce frequency of use on roads in energy developments in PPH.

- **Require speed limits and management that minimize traffic on roads within 3 km of active leks as presented in Alternative B and as research supports**. Additionally, sound abatement modifications to vehicles being used in energy development may reduce the impact of road noise on breeding sage-grouse and should be considered as a PDF if technically feasible (see Patricelli et al. 2013).

For RDF/PDF #3: Co-locate or cluster infrastructure of energy developments in PPH; see discussion under Fluid Minerals—Leased

Analysis of RDF/PDF #4: Place utilities (power lines, pipelines, etc.) in existing utility or transportation corridors and bury distribution power lines in PPH

Although results are not conclusive, power lines associated with coal-bed methane development may negatively influence sage-grouse. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4-km window around leks. It is worth noting that distances to power lines and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors as gas wells. See also discussion under rights-of-way below.

Similarly, results of the impacts of pipelines to sage-grouse are inconsistent. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where pipeline densities exceeded 0.47 km/km^2. Conversely, Johnson et al. (2011) found no consistent relationship between lek count trends and distance to or densities of pipelines within 5 or 18 km of leks.

Recommendation for RDF/PDF #4: Place utilities (power lines, pipelines, etc.) in existing utility or transportation corridors, and bury distribution power lines in PPH

- **Institute the stipulations as presented in the preferred alternative, which are sufficient**.

Analysis of RDF/PDF #5: Discourage nesting of raptors and corvids on aboveground facilities (potential nesting substrate) and clean up refuse (supplemental food source) to reduce corvid presence in energy fields in PPH

Coates and Delehanty (2010) reported that sage-grouse nest survival probabilities decreased as raven abundance increased, especially in areas with relatively low sagebrush canopy cover. Bui et al. (2010) found that raven density and occupancy were greatest in land covers with frequent human activity. Although the authors found that raven abundance indices were not related to nest or brood success, they noted that raven occupancy near nests and broods was more highly correlated with success than were raven density and behavior. This suggests that the majority of nest predation by ravens is carried out by resident territorial individuals. Dinkins (2013) found that sage-grouse nest success was negatively impacted by the presence of ravens, and female summer survival was negatively impacted by golden eagle densities. It is worth noting, however, that the author mentioned there was not a strong connection between raven control efforts and increased sage-grouse nest success.

Recommendation for RDF/PDF #5: Discourage nesting of raptors and corvids on aboveground facilities (potential nesting substrate) and clean up refuse (supplemental food source) to reduce corvid presence in energy fields in PPH

- **Adopt the stipulations outlined in Alterative B, which are supported by the scientific literature.** Research suggests that management aimed toward reducing the use of energy development infrastructure by nesting raptors and corvids and eliminating supplemental food sources for raptors and corvids should be required. Also, it may benefit this RDF/PDF to specifically include roadkill as “refuse.”

Analysis of RDF/PDF #6: Limit noise to <10 decibels above ambient measures at the perimeter of leks during breeding season in PPH

Beyond the impact of road noise on lek counts cited above, Blickley et al. (2012) reported that peak male attendance at leks experimentally treated with noise from natural gas drilling rigs decreased 29% relative to paired controls.

Recommendation for RDF/PDF #6: Limit noise to <10 decibels above ambient measures at the perimeter of leks during breeding season in PPH

- **Limit anthropogenic noise to <10 decibels above ambient measures at the periphery of leks during the breeding season as presented in Alternative B and supported by research**. Ambient noise levels should be established at least on a region-by-region basis (see Patricelli et al. 2013).

Analysis of RDF/PDF #7: Locate "man camps" outside of PPH

Urbanization, which a man or crew camp would be considered to be, may negatively influence sage-grouse habitat selection and probability of population persistence. Wisdom et al. (2011) reported that human density was 26 times lower in occupied sage-grouse range compared to historically occupied but currently extirpated range. Aldridge and Boyce (2007) found that brood-rearing females avoided habitats associated with a high density of urban developments; it is worth noting that "urban" was defined as towns, farmsteads, and energy infrastructure.

Recommendation for RDF/PDF #7: Locate man camps outside of PPH

- **Locate man camps outside of PPH as presented in Alternative B** and is supported by research

Analysis of RDF/PDF #8: Remove trees within 100 m of occupied greater sage-grouse leks and other seasonal habitats in ADH

Doherty (2008) found that nesting sage-grouse avoided conifer-dominated habitats at distances of 0.10 km. Baruch-Mordo et al. (2013) found that the probability of lek persistence was lower in areas where conifers were dispersed throughout an area designated by a 1-km-radius buffer, with the probability of persistence approaching 0% at conifer canopy cover values >6% within this area. Miller et al. (2011) suggest that a relationship exists whereby sagebrush canopy cover declines below 15% when juniper cover exceeds approximately 12%, and that sagebrush canopy cover declines below 10% when juniper cover exceeds approximately 18%. The sage-grouse habitat management guidelines (Connelly et al. 2000) suggest that productive sage-grouse nesting habitat is characterized by sagebrush canopy cover exceeding 15%, and that productive brood-rearing and winter habitats are characterized by sagebrush canopy cover exceeding 10%.

Recommendation for RDF/PDF #8: Remove trees within 100 m of occupied greater sage-grouse leks and other seasonal habitats in ADH

- **Remove conifer trees from within 1000 m of occupied leks,** especially in areas where trees are widely dispersed and tree canopy cover is approaching 6% within this area, as research suggests.

<u>Solid Minerals—Coal</u>

Summary of DEIS for Solid Minerals—Coal

The preferred alternative stipulates no surface mining for coal in ADH, surface infrastructure for subsurface coal mines in ADH needs to be placed outside of PPH, and surface disturbance within ecological sites that support sagebrush in PPH cannot exceed 5% in any Colorado management zones. Alternative B stipulates the same actions as the preferred alternative, except that surface infrastructure for subsurface coal mines can be placed in disturbed habitats within PPH, and no surface disturbance threshold is forwarded (although a 3% surface disturbance cap is implied by previous stipulations forwarded under development stipulations for leased fluid minerals).

Analysis of Solid Minerals—Coal
As discussed above, neither the preferred alternative nor Alternative B provides for the potential that surface disturbing activities associated with surface or subsurface coal mining may negatively impact sage-grouse indirectly. Placing infrastructure on the border of PPH—or in disturbed areas within PPH, as stipulated in Alternative B—may negatively impact PPH via indirect means. The lack of information specifically supporting a 3% or 5% surface disturbance cap is also discussed above, but it is worth noting again that, although a specific surface disturbance threshold is currently unknown, multiple studies have found negative relationships between increasing amounts of infrastructure on the landscape in terms of well densities and sage-grouse lek counts and habitat suitability.

The information and recommendations forwarded under Fluid Minerals above apply here.

<u>Locatable Minerals</u>
The preferred alternative stipulates that seasonal timing restrictions should be applied if deemed necessary and that RDFs and PDFs should be applied as mandatory COAs. Alternative B does not differ from the preferred alternative. Although the DEIS stipulates that PDFs and RDFs will be applied as mandatory COAs in both the preferred alternative and Alternative B, Appendix I indicates that all are Suggested Design Features (SDFs) for locatable minerals in both alternatives. SDFs were similar to those described under fluid minerals but added the following: (1) all SDFs applied to ADH; (2) place infrastructure in already disturbed locations where habitats have not been restored; and (3) restrict construction of tall facilities and fences to the minimum number and length needed. The removal of trees within 100 m of occupied greater sage-grouse leks and other seasonal habitats in ADH was not included as a SDF for locatable minerals.

As for SDF #2 regarding the placement of infrastructure in already disturbed locations, this stipulation provides for the potential that surface disturbing activities associated with locatable mineral mining may negatively impact sage-grouse indirectly. **The information and recommendations forwarded under Fluid Minerals above apply here**.

As for SDF #3 that restricts construction of tall facilities and fences*,* Stevens et al. (2012) reported that sage-grouse fence collision risk was lower in areas with high topographic ruggedness, and was higher in areas with increased fence density on the landscape, with decreased distance to nearest lek (fences within approximately 2 km of leks), and with increased lek size.

Recommendation for SDF #3: Restrict construction of tall facilities and fences to the minimum number and length needed

- **Require the marking of newly constructed fences, especially those that are constructed in high risk areas near leks or those bisecting feeding and roosting cover** (e.g., fences situated between mesic areas and sagebrush uplands (see Christiansen 2009). Research supports the use of fence marking procedures to reduce collision risk with necessary fences—as well as a management alternative to reduce risk on existing fences. Stevens et al. (2012) and Christiansen (2009) found that marking the top strand of a fence at 1-m intervals with vinyl-siding undersill affixed with reflective metallic tape on both sides reduced sage-grouse collision frequency on high-risk fences of 61-83%.

<u>Non-energy Leasable Minerals</u>

Summary of DEIS for Non-energy Leasable Minerals

The preferred alternative stipulates that existing non-energy leasable minerals leases will be allowed to expand in PPH given that surface disturbance in ecological sites that support sagebrush in PPH does not exceed 5% in any Colorado management zone. Alternative B, on the other hand, closes PPH to non-energy leasable minerals leasing, including the expansion of existing leases. Both alternatives stipulate that RDFs and PDFs should be applied as mandatory COAs. The lack of research supporting a 5% threshold on surface disturbance along with the research supporting minimization of the amount of surface disturbance in sage-grouse habitats is discussed at length above. It is worth noting that although both the preferred alternative and Alternative B stipulate that RDFs and PDFs be applied as mandatory COAs for non-energy leasable minerals, no RDFs or PDFs were listed in Appendix I specific to non-energy leasable minerals activities. Assuming the DEIS is referring to the design features listed for fluid minerals, the analysis asserted above would be applicable here.

Recommendations relative to the surface disturbance threshold and energy development within ADH are discussed at length above and are applicable here.

<u>Salable Mineral Materials</u>

Summary of Salable Mineral Materials

The preferred alternative stipulates that existing salable mineral materials leases will be allowed to continue and expand in PPH, given that surface disturbance in ecological sites that support sagebrush in PPH does not exceed 5% in any Colorado management zone. Conversely, Alternative B closes PPH to salable mineral material sales. The lack of research supporting a 5% threshold on surface disturbance, along with the research supporting minimization of the amount of surface disturbance in sage-grouse habitats, is examined above.

Recommendations relative to the surface disturbance threshold and energy development within ADH are discussed at length above and are applicable here.

Range Management

Summary of DEIS for Range Management

The preferred alternative and Alternative B establish that sage-grouse habitat objectives and management considerations—outlined in Appendix K—be incorporated into the terms and conditions for all BLM grazing allotment permits in ADH. The preferred alternative allows for the authorization of new water developments in ADH only after determining that developments will not adversely impact sage-grouse. Also stipulated in the preferred alternative is that a minimum of 70% of the ecological sites capable of supporting ≥12% canopy cover of Wyoming big sagebrush or ≥15% canopy cover of mountain big sagebrush be retained in sagebrush habitat for ADH by Colorado management zone. Alternative B differs from the preferred alternative in the last two stipulations mentioned in that new water developments would be authorized in PPH only when PPH would benefit from the development, and only treatments that conserve, enhance, or restore sage-grouse habitat would be allowed in PPH.

Analysis of Range Management

Appendix K specifically states that "the herbaceous standing crop from previous year is a critical factor for nesting cover" (Page K-5, lines 16-17), but the standards outlined do not address this situation. Cagney et al. (2010) contend that the potential exists to manage livestock on a site compatible with maintaining the long-term plant health on the site while failing to achieve sage-grouse habitat objectives. The influence of livestock grazing on sage-grouse is a function of both long-term management that promotes suitable plant communities and annual management of standing crop (i.e., residual herbaceous cover) to provide cover primarily to nesting sage-grouse (Cagney et al. 2010). Long-term and annual management objectives need to be considered, but Cagney et al. (2010) suggest that both can be achieved by managing livestock to meet annual objectives.

Although limited, research suggests that water developments are generally not advantageous to sage-grouse. Movements of sage-grouse to summer range are thought to be in response to range desiccation and not a lack of free water (Connelly and Doughty 1989), and research suggests that sage-grouse do not regularly use water developments, even during relatively dry years (Connelly 1982, Connelly and Doughty 1989). Connelly et al. (2004) maintain that the primary influence of water developments on sage-grouse has been the alteration of movements and distributions of livestock whereby water developments have opened more rangeland to livestock grazing pressures and the potential consequences of these pressures. Connelly and Doughty (1989) reported that water developments tend to attract other animals and may serve as predator sinks for sage-grouse. See also discussion of the design of water developments relative to West Nile virus above.

Although the premise of the stipulation forwarded in Alternative B that only treatments that conserve, enhance, or restore sage-grouse habitat be allowed is on the surface sound, it is extremely important to note that the enhancement or restoration of sagebrush habitats is not a trivial task. There is tremendous uncertainty as to the vegetative and sage-grouse population outcomes of habitat manipulations (Johnson and Holloran 2010). Miller and Eddleman (2001) concluded that there exists no evidence to suggest treatment will enhance sage-grouse habitat in Wyoming big sagebrush-dominated communities that already have a balance of native shrubs, perennial grasses, and forbs. The Sage and Columbian Sharp-tailed Grouse Technical Committee (2009) suggests that the scientific evidence supporting the use of prescribed fire for sage-grouse conservation is scant, while considerable information documenting negative effects of fire on sage-grouse exists. The authors recommend avoiding the use of prescribed fire in xeric sagebrush habitats. Beck et al. (2009), after investigating the impact to wintering, nesting, and early brood habitat 14 years post-burn, concluded that land managers should not consider prescribed fire in xeric sagebrush habitats. Both the preferred alternative and Alternative B do not allow the use of fire to treat sagebrush in low precipitation zones. Connelly et al. (2000) recommend that a minimum 3.2-km-radius of sagebrush should be protected around known leks for nonmigratory populations; protection buffers may have to increase for migratory populations. Braun et al. (1977) suggest that sagebrush along streams, drainages, and meadows be protected as these areas provide important summer habitat.

Research suggests that 80% of the ecological sites capable of supporting sagebrush with suitable canopies be retained. Connelly et al. (2000)—in the sage-grouse habitat management guidelines—recommend that no more than 20% of the nesting, early brood-rearing, and wintering habitats (in combination) in a landscape be in a treated state at any one time. Productive nesting, early brood-rearing, and winter habitats are those characterized by 10-30% sagebrush canopy cover, and recovery from treatment should be considered ≥12% canopy cover in Wyoming big sagebrush and ≥15% in mountain big sagebrush-dominated areas (Connelly et al. 2000). Swenson et al. (1987) reported that the conversion of 30% of the wintering sagebrush-dominated habitats in a 202-km^2 area by plowing resulted in a 73% decline in the number of breeding male sage-grouse on leks in the area relative to controls.

Recommendation for Range Management

- **Ensure that at least 80% of suitable sagebrush canopies are retained during vegetative treatment, as supported by the research.** Neither research nor the current sage-grouse habitat management guidelines support the 70% threshold in the alternatives.
- **Add annual livestock management practices that result in suitable residual herbaceous height and cover for nesting sage-grouse to Appendix K.**
- **Allow water developments in PPH only when these developments are necessary to implement management protocols that will enhance PPH, as is implied in Alternative B.**
- **Include language establishing the uncertainty surrounding enhancement of sagebrush habitats with treatment.** Any regional plans that incorporate proactive habitat management as a conservation action needs to be generated from an analysis of all available information, including projections of the vegetative and sage-grouse population response to potential management actions, outlines of specific pre- and post-treatment monitoring requirements, and mechanisms to set in motion a process whereby data from implemented actions are used to inform future actions in an iterative cycle where mitigation actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The

adaptive context established by a mitigation plan iteratively evaluated is extremely important given the uncertainty surrounding sagebrush habitat management.

Rights-of-Way (ROW)

Summary of DEISs for ROW

The preferred alternative makes PPH avoidance areas for new ROW permits, and makes priority sage-grouse habitat areas exclusion areas for large transmission lines. Any new projects in PPH would be subject to the 5% surface disturbance cap described above. The preferred alternative also establishes that existing power lines would be removed, buried or modified in PPH, and that raptor perch deterrents would be required on lines where these options are not tenable. The preferred alternative differs from Alternative B in that Alternative B makes PPH exclusion areas for new ROW permits and new projects in PPH subject to the 3% surface disturbance cap described above. The use of perch deterrents is not stipulated. It is unclear in the DEIS if "priority sage-grouse habitat areas" are specially designated habitat areas within PPH or if this description refers to PPH. The DEIS describes avoidance areas as areas where restrictions and mitigation measures could be modified on a case-by-case basis, whereas exclusion areas are strictly prohibited from ROW development.

Analysis of ROW

As mentioned above, research investigating the impacts of transmission and power lines on sage-grouse is not conclusive but suggests that these structures may negatively influence sage-grouse habitat selection and survival. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.2 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission lines increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Other often-cited studies that may provide evidence of impacts of power lines on sage-grouse include Braun (1998), who reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data; Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day-use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within two years, but this study had a sample size of one lek. Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only two juvenile grouse were killed by running into power lines.

Slater and Smith (2008) reported that perch deterrents reduced the occurrence of corvids and raptors relative to a control (non-deterred) line but that perching was not entirely prevented. Lammers and Collopy (2007) found that perch deterrents reduced the probability of a raptor or corvid perching on a power pole and reduced the duration of perching, but they also reported that perching was not entirely prevented by perch deterrents. In contrast, Prather and Messmer (2010) found that perch deterrents were ineffective at reducing the number of perch events of raptors and corvids.

Recommendation for ROW

- Maintain **the option of changing sage-grouse habitats from avoidance to exclusion areas for ROW in the DEIS.** As research results become available, there may be increased support for establishing all sage-grouse habitat as exclusion areas for ROW.
- **Clearly explain what is meant by "priority sage-grouse habitat areas."** The stipulation establishing priority sage-grouse habitat areas as exclusion areas for large transmission lines should be reworded to more clearly explain what is meant by "priority sage-grouse habitat areas." It is unclear if this is referring to specifically designated areas within PPH or a PPH itself.

Land Tenure Adjustment

The preferred alternative stipulates that public ownership of PPH should be retained and that land exchanges that would allow for additional or contiguous federal ownership of PPH should be considered. This does not differ from Alternative B. Wisdom et al. (2011) reported that currently occupied sage-grouse range had substantially more public ownership compared to extirpated range; 64% of the 18-km-radius circles encompassing historical locations in occupied range were dominated by public land, compared to 26% in extirpated range.

The stipulations presented in the preferred alternative are sufficient.

Fire

Summary of DEIS for Fire

The preferred alternative stipulates that a minimum of 70% of the ecological sites capable of supporting ≥12% canopy cover of Wyoming big sagebrush or ≥15% canopy cover of mountain big sagebrush be retained in sagebrush habitat for ADH by Colorado management zone. Treated areas should be rested from livestock for two full growing seasons following treatment in ADH. No similar action to the retention of 70% sagebrush habitat was forwarded in Alternative B other than that no treatments in known winter range in PPH would be allowed unless necessary. Post-treatment livestock management stipulations were the same for both alternatives.

Analysis of Fire

Stipulating rest from livestock for two years post-treatment may not be sufficient in some cases. Knick et al. (2011) contend that the reintroduction of livestock to a treated area before the native or reseeded plant community becomes established, regardless of the number of years of rest afforded the site, can result in failed rehabilitation efforts and increased levels of exotic grasses. Bates et al. (2009) suggest that timing, intensity, and duration of grazing treated habitats may be more important than a specific period of rest following a fire.

A discussion of the 70% retention cap is provided above under range management.

Recommendation for Fire

- **Ensure that at least 80% of suitable sagebrush canopies are retained during vegetative treatment, as supported by the research.** Neither research nor the current sage-grouse habitat management guidelines supports the 70% threshold in the alternatives. **Specifically state that prescribed fire is not considered a viable treatment option for improving habitat conditions for sage-grouse in areas where fire is not being used to specifically target range issues (e.g., cheatgrass) as proposed in Alternative B**.

Travel Management

Summary of DEIS for Travel Management

The preferred alternative allows for upgrading of existing travel routes if upgrades do not negatively affect sage-grouse populations in PPH. In contrast, Alternative B does not allow for the upgrade of existing routes that change route category (road, primitive road, or trail) or capacity unless necessary in PPH. Both alternatives stipulate the need for evaluating and implementing permanent or seasonal road or area closures in ADH (preferred alternative) or PPH (Alternative B).

Analysis of Travel Management

Sage-grouse avoidance of high-activity roads is well-documented. Connelly et al. (2004) found that no leks occurred within 2 km of Interstate 80, there were fewer leks within 7.5 km than within 15 km of the interstate, and there were higher rates of decline in lek counts between 1970 and 2003 on leks located beyond 7.5 km of the interstate. Knick et al. (2013) reported that high habitat suitability was associated with <1.0 km/km^2 of secondary roads, 0.05 km/km^2 of highways, and 0.01 km/km^2 of interstate highways within 5-km-radius areas. LeBeau (2012) found that sage-grouse avoided nesting and summering near major roads (e.g., paved secondary highways). Tack (2009) found negative relationships with more roads around leks at all levels of lek attendance, but impacts were greatest for larger leks (>25 males). The probability of occurrence of a large lek was 50% with road densities of approximately 25 km of road within 3.2 km of a lek. Dzialak et al. (2012) documented sage-grouse during the winter avoiding haul roads associated with natural gas development. In contrast, results from some of the smaller road categories, Johnson et al. (2011) found negative trends with distance to an interstate highway—although few leks occurred near interstates; relatively consistent slight negative trends with distance to highways; and no relationship between distance to secondary roads and lek trends. Road densities within 5-km-radii of leks suggested similar relationships by road category (Johnson et al. 2011). See also discussion above on reducing speeds and activity on roads.

Recommendation for Travel Management

- **Do not allow the upgrading of roads if it allows for greater capacity in PPH, as presented in Alternative B.**

Wind Energy Development

Neither the preferred alternative nor Alternative B stipulates actions relative to wind energy development. LeBeau et al. (*in press*) reported that the risk of a nest or a brood failing decreased by 7.1% and 38.1%, respectively, with every 1-km increase in distance from the nearest wind turbine. No variation in female survival was detected relative to wind energy infrastructure (LeBeau et al. *in press*).

Recommendation for Wind Energy

- **Subject wind energy developments and associated infrastructure to the 5% (or modified proportionally) surface disturbance cap implemented for nonrenewable energy and mining in PPH.**

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General Comment

The preferred alternative requires “no net unmitigated loss of PPMA” (Preliminary Priority Management Area). Although discussed at length below, it is worth stating upfront that even though the premise of “no net unmitigated loss of habitat” is well-intentioned, tremendous uncertainty exists as to the vegetative and sage-grouse population outcomes of habitat treatments. Some treatments may be prudent to address habitat degradation because habitat degradation is a significant causal factor in sage-grouse declines (see Connelly et al. 2004). However, a conservative or limited approach to proactive habitat manipulations is warranted because we do not have all, or even many, of the answers when it comes to improving sagebrush habitat conditions for sage-grouse.

In general, PPMA incorporates sagebrush-dominated habitats within 6.4 km of leks where a high proportion of the population within the region breeds, plus connectivity areas (see Appendix I for a detailed description of methods employed).

Fluid Minerals

Summary of DEIS for Fluid Minerals—Unleased

The preferred alternative closes areas of no or low potential for fluid minerals in PPMA to leasing, but areas of moderate to high potential for discovery in PPMA are open to leasing subject to seasonal timing restrictions in breeding and winter habitats. Open areas are also subject to a disturbance density cap of one disturbance per section (square mile), a maximum of 3% surface disturbance per section, and NSO within 0.6 mile of leks. Preliminary General Management Areas (PGMA) are open to leasing under the preferred alternative with a 0.6-mile NSO buffer around leks. Under Alternative B—the alternative in the DEIS most closely aligned with the recommendations forwarded in the NTT report—PPMA would be closed to leasing, and under the no-action alternative, PGMA would be managed under the no action alternative (i.e., no change to management).

Summary of Fluid Minerals—Leased

The preferred alternative stipulates that proposed surface disturbance on leased fluid mineral estates must achieve a no net unmitigated loss of PPMA. Alternative B establishes an NSO in PPMA and winter concentration areas except when the entire lease is within PPMA, a 4-mile NSO would be implemented where feasible, and surface disturbance would be limited to one per section (square mile) with no more than 3% surface disturbance of that section. Additionally, a seasonal timing restriction on exploratory drilling that prohibits surface disturbing activities during nesting and early brood-rearing in PPMA would be applied under Alternative B. Both alternatives would require unitization when deemed necessary and apply mandatory Best Management Practices (BMPs; Appendix C) as COAs in PPMA. The preferred alternative also establishes BMPs as mandatory COAs in PPMA and PGMA. Among other provisions, these BMPs include the clustering of infrastructure and the use of anti-perching devices.

Analysis of Fluid Minerals

Although the premise of the stipulation forwarded in the preferred alternative that all surface disturbance in PPMA will be mitigated is on the surface sound, the enhancement or restoration of sagebrush habitats is not a trivial task. There is tremendous uncertainty as to the vegetative and sage-grouse population outcomes of habitat manipulations (Johnson and Holloran 2010). Managers often justify habitat manipulations with potential long-term benefits, but the long-term effects of most of the available habitat manipulation options on habitats and consequences to sage-grouse are unknown. Extreme caution and discretion should be employed when proposing a habitat treatment, especially on drier sites, sites where cheatgrass may invade, and sites with limited potential to produce sagebrush (e.g., the interface between the Wyoming Basin and the Great Plains; Cagney et al. 2010). As mentioned above, this is not to say efforts to address habitat degradation should be avoided. Conservative and well-reasoned, supported approaches to implementation and evaluation are strongly encouraged. Although mitigation plans should be developed at landscape spatial scales, development at this scale does not necessitate that treatments be implemented across these scales. Small-scale, case-by-case treatment regimens conducted over the long term should be implemented.

The potential indirect effects of infrastructure on sage-grouse were not addressed by either the preferred alternative or Alternative B. This may be important in situations where infrastructure is placed outside of PPMA but within close proximity to the PPMA boundary. Several authors have reported a distance-effect associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts to lekking sage-grouse of well pads located closer to leks were more consistently observed across energy fields compared to well pads farther away, with a consistent pattern whereby the presence of well pads within smaller radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development to the number of males occupying leks were greatest when infrastructure was located near the lek, and that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species. Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011)

reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

Research directly relevant to the efficacy of a 0.6-mile NSO buffer is not available. However, leks that had at least one well pad within 0.4 km (0.25 miles) had 35-92% fewer sage-grouse compared to leks with no well pads within this radius (Harju et al. 2010). Walker et al. (2007) reported that implementing a 0.4-km NSO given full field development within the remainder of a 0.8-km- or 3.2-km-radius area would result in lek persistence probabilities of 5% and 24%, respectively.

A substantial amount of research suggests that reducing infrastructure densities around leks will benefit sage-grouse. However, no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Harju et al. (2010) reported that common well pad densities of four and eight pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below one pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding one well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (eight pads/section).

Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the “developed” covariate examined included urban and suburban areas, and interstate and state highways as classified by Landfire (2006) and was quantified within 1-km grid cells. Therefore, the results may not be comparable to how the stipulations in Alternative B are forwarded.

Unitization may benefit sage-grouse by resulting in the co-location or clustering of infrastructure of energy development. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al. (2007) found that gas development within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities; gas development in this study was measured as the proportion of area around a lek within 350 m of gas field infrastructure—in other words, the proportion of a 0.8-km-radius area around a lek within 350 m of infrastructure. It is worth noting that the potential benefits of co-location or clustering infrastructure (listed as a BMP) of energy developments may be noncompatible with the per-section surface disturbance thresholds as forwarded in the preferred alternative where permitted disturbances are limited to one per section with no more than 3% surface disturbance in that section. Limiting disturbance to one well pad/infrastructure and 3% surface disturbance per section as established in the preferred alternative, unless quantified as an average across a larger landscape, will counteract and contradicts the requirement of clustering infrastructure. Surface disturbance caps are described as being restricted similarly in Alternative B.

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse during the winter avoiding the infrastructure of a gas field during the day, but not at night. This suggests that the sage-grouse avoided human activity rather than the infrastructure itself. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a five-year period; traffic levels were not measured but increased levels were inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls; the authors found that the intermittent nature of noise from roads affected male sage-grouse to a greater degree than more constant noise as that from a drilling rig. These studies would suggest timing restrictions may be effective if human activity around infrastructure in or near seasonal ranges is eliminated or minimized.

Slater and Smith (2008) reported that perch deterrents reduced the occurrence of corvids and raptors relative to a control (non-deterred) line, but that perching was not entirely prevented. Lammers and Collopy (2007) found that perch deterrents reduced the probability of a raptor or corvid perching on a power pole and reduced the duration of perching, but they also reported that perching was not entirely prevented by perch deterrents. In contrast, Prather and Messmer (2010) found that perch deterrents were ineffective at reducing the number of perch events of raptors and corvids.

Recommendation for Fluid Minerals

- **Minimize indirect effects of energy development. For unleased areas in PPMAs, Alternative B is supported by the scientific literature**. The preferred alternative does not directly address indirect effects of infrastructure. However, given the process for delineating PPMAs (e.g., a 4-mile buffer around leks), indirect effects of energy development to sage-grouse on leks should in general be minimized by the NSO stipulation forwarded in Alternative B. The potential indirect effects of infrastructure placed in non-habitat or in PGMAs are not addressed in Alternative B.

- **Institute stipulations for leased areas in PPMAs, as forwarded by Alternative B, which are supported by the scientific literature.** Given the reliance of the preferred alternative on mitigation and the uncertainty surrounding actions that effectively and consistently enhance sagebrush habitats, at a minimum, **language should be added to the preferred alternative establishing the uncertainty surrounding enhancement of sagebrush habitats with treatment.**
- **Require that all areas, regardless of habitat designation, within 2 to 4 km of a lek as NSO for lower activity sites (e.g., producing well pads) and all areas within 6 to 6.4 km of a lek as NSO for higher activity sites (e.g., drilling rigs). Additionally consider restricting fluid mineral development in all areas, regardless of habitat designation, within 2 km of winter range and within 1 km of nesting habitats.** These suggestions are in addition to the NSO established in PPMAs in Alternative B.
- **Expand Appendix F into a more detailed regionwide habitat management plan that addresses site-specific actions in the context of the landscape**. The plan should be generated from an analysis of all available information, including projections of the vegetative and sage-grouse population response to potential management actions, outlines of specific pre- and post-treatment monitoring requirements, and a process whereby data from implemented actions are used to inform future actions in an iterative cycle where mitigation actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The adaptive context established by a mitigation plan iteratively evaluated is extremely important given the uncertainty surrounding sagebrush habitat management.
- **Employ a technique limiting infrastructure densities that allows for and encourages the clustering or co-locating of infrastructure on the landscape.** Research supports the minimization of energy development infrastructure densities to one per section averaged across an area designated by a 3- to 3.2-km radius. Additionally, research suggests that the co-location or clustering of infrastructure reduces impacts of energy development to sage-grouse by reducing the proportion of a landscape indirectly influenced by that infrastructure. Infrastructure density thresholds should be calculated across a larger area than 1 square mile to allow for clustering of infrastructure while maintaining an average of one pad/section**.** It is worth noting that the 3% anthropogenic surface disturbance threshold, if calculated at the scale of a square mile as established in the preferred alternative as well as Alternative B, will not alleviate the need to address co-location.
- **Minimize human activity at infrastructure placed within seasonally protected areas**. Although seasonal timing restrictions are stipulated in the preferred alternative, recommendations forwarded in the literature as well as the NTT report suggest seasonal timing restrictions are ineffective. For example, Appendix C ("Greater Sage-grouse Habitat Required Design Features and Best Management Practices") lists the following as RDFs for fluid mineral development in priority habitats: "establish trip restrictions or minimization through use of telemetry and remote well control" and "place liquid gathering facilities outside of priority areas" as well as the following for development in

general habitats: "use remote monitoring techniques for production facilities and develop a plan to reduce the frequency of vehicle use"; requiring these practices when developing fluid minerals in sage-grouse habitats could reduce human activity levels in these areas.

- **Avoid substituting anti-perching devices for burial or elimination of power lines to maintain core habitats** because perch-deterrents reduce but do not eliminate perching on power poles by raptors and corvids.

Locatable Minerals

Summary and Recommendation for Locatable Minerals

Sage-grouse habitats would remain open to locatable mineral development under the preferred alternative. Under Alternative B, PPMAs would be recommended for withdrawal from locatable mineral entry.

The literature reviewed under Fluid Minerals would apply here. Because of the uncertainty associated with the efficacy of sagebrush habitat enhancement and the reliance of the preferred alternative on "no net unmitigated loss of PPMAs," **Alternative B is generally supported; but see the recommendations forwarded under the Fluid Minerals section above**.

Salable Minerals

Summary and Recommendation for Salable Minerals

A 3-km NSO around leks and seasonal timing restrictions would be implemented in sage-grouse habitats under the preferred alternative. Alternative B closes PPMAs to mineral material sales.

Approximately 80% of female sage-grouse nest within 4 miles of the lek where bred (Colorado Greater Sage-grouse Steering Committee 2008), whereas approximately 62% of females nest within 3 miles of the lek where bred (Holloran and Anderson 2005).

As detailed above, the distance from a lek to apply an NSO should be based on the activity level of infrastructure as well as the objective of the NSO. To encompass a majority of the nesting population and to minimize effects of high activity developments, **a 4-mile lek buffer is required as is essentially established in Alternative B.**

Fuels Management

Summary of DEIS for Fuels Management

The preferred alternative allows for a variety of treatment methods—including prescribed fire—to be used for treating sagebrush communities. Alternative B does not allow prescribed fire in sagebrush communities.

Analysis of Fuel Management

The Sage and Columbian Sharp-tailed Grouse Technical Committee (2009) suggests that the scientific evidence supporting the use of prescribed fire for sage-grouse conservation is scant while considerable information documenting negative effects of fire on sage-grouse exists. The authors recommend avoiding the use of prescribed fire in xeric sagebrush habitats. Fischer et al. (1996) reported that the abundance and biomass of ants was reduced the second and third years after treatment. Nelle et al. (2000) reported a significant increase in ant and beetle abundance one year after treatment, but abundance levels had returned to untreated level within 3 to 5 years. Slater (2003) reported no difference in abundance or biomass between treated and untreated sites. These results suggest treatments may have limited utility as a tool for sage-grouse brood-rearing habitat management. Slater (2003) also reported no difference in nest success probabilities within and outside burn boundaries (35% vs. 20%, respectively). Overall nest success in his study (24%) was very low, suggesting potential impacts to nest success at spatial scales larger than actual treatments. Nelle et al. (2000) reported that prescribed fire negatively affected habitat conditions for sage-grouse nesting and brood-rearing up to 15 years post-burn. Beck et al. (2009), after investigating the impact to wintering, nesting, and early brood habitat 14 years post-burn, concluded managers should not consider prescribed fire in xeric sagebrush habitats.

Recommendation for Fuel Management

- **Do not include prescribed fire as a tool for treatments meant to improve habitat conditions for sage-grouse in areas where fire is not being used to specifically target range issues (e.g., cheatgrass), as supported by Alternative B.**

Rights-of-Way (ROW)

Summary of DEIS for ROW

The preferred alternative designates PPMA as ROW avoidance areas. PPMA is considered exclusion areas for ROW under Alternative B.

Analysis of ROW

Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggests that these structures may negatively influence sage-grouse habitat selection and survival. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.2 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission line increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors as gas wells. See also discussion under rights-of-way below. Other often-cited studies that may provide evidence of impacts of power lines on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data; Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within two years, but this study had a sample size of one lek; and Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only two juvenile grouse were killed by running into power lines.

Recommendation for ROW

- Maintain **the option of changing sage-grouse habitats from avoidance to exclusion areas for ROW in the DEIS.** As research results become available, there may be increased support for establishing all sage-grouse habitat as exclusion areas for ROW.

Travel Management

The preferred alternative establishes that travel management planning would occur at a later date. Thus the DEIS does not provide the information necessary to evaluate the effectiveness of this alternative relative to management of roads.

Billings (MT) Draft RMP/EIS

General Observation

The potential effectiveness of the preferred alternative is dependent to a large degree on site-specific assessments and the determination of suitable management actions based on these assessments, which are yet to be completed or otherwise not available. The primary examples include livestock grazing management, management of noxious weeds, and travel management. It is worth noting that the DEIS references Appendix AB ("Mitigation Measures and Conservation Actions for Greater Sage-grouse Habitat"), which includes many of the management recommendations forwarded in the NTT report; including the conservation actions and BMPs outlined in this appendix as required land-use actions for the issues listed below, as well as plans yet to be developed, would strengthen the proposed approach to sage-grouse management.

Fluid Minerals

Summary of DEIS for Fluid Minerals

The preferred alternative allows for fluid mineral leasing in Protection Priority Areas (PPA), but with a No Surface Occupancy (NSO) stipulation. Essentially, under the preferred alternative, fluid minerals can be leased in PPAs but must be accessed from infrastructure placed outside of PPA boundaries. Surface occupancy and use is prohibited within 0.6 miles of sage-grouse leks, and a seasonal timing restriction prohibits surface use from March 1 through June 30 within 3 miles of sage-grouse leks in Restoration Areas (RA) and General Habitat Areas (GHA). Surface use is prohibited within sage-grouse winter range from Dec. 1 through March 1. Timing restrictions do not apply to operation and maintenance of production facilities. These differ from Alternative B—the alternative in the DEIS most closely aligned with the recommendations forwarded in the NTT report—in that Alternative B closes PPAs to future oil and gas leasing, exploration and/or development; establishes a timing restriction prohibiting surface use from March 1 through June 30 within 4 miles of sage-grouse leks in RAs and GHAs; and requires unitization where feasible. PPA in Montana was initially delineated by buffering leks and lek complexes by 4 miles and generating polygons of those merged buffers that included large proportions of males based on 2005-07 lek counts (see Doherty et al. 2011); these initial polygons were then refined based on local knowledge.

Greater sage-grouse oil and gas stipulations (Appendix C): Surface occupancy and use activities in RAs and GHAs are restricted to one surface disturbance per 640 acres, with a cumulative disturbance of no more than 5% of the sagebrush habitat in the 640 acres.

Analysis of Fluid Minerals

Other than the seasonal timing restriction actions forwarded under the preferred alternative, the potential indirect effects of infrastructure on sage-grouse were not addressed. Several authors have reported a distance-effect associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts to lekking sage-grouse of well pads located closer to leks were more consistently observed across energy fields compared to well pads farther away, with a consistent pattern whereby the presence of well pads within smaller radius buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development to the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species. Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

Research relevant to the efficacy of the 0.6-mile NSO is not available. However, leks that had at least one well pad within 0.4 km (0.25 miles) had 35-92% fewer sage-grouse compared to leks with no well pads within this radius (Harju et al. 2010). Walker et al. (2007) reported that implementing a 0.4-km NSO given full field development within the remainder of a 0.8-km- or 3.2-km-radius area would result in lek persistence probabilities of 5% and 24%, respectively.

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse avoiding the infrastructure of a gas field during the day, but not at night. This suggests that avoidance was of human activity rather than the infrastructure itself. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a five-year period. Traffic levels were not measured but increased levels were inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig. These studies would suggest timing restrictions may be effective if human activity around infrastructure in or near seasonal ranges is eliminated or minimized.

Approximately 80% of female sage-grouse nest within 4 miles of the lek where bred (Colorado Greater Sage-grouse Steering Committee 2008), and approximately 62% of females nest within 3 miles of the lek where bred (Holloran and Anderson 2005).

Substantial amounts of research suggest that reducing infrastructure densities around leks will benefit sage-grouse. However, no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Harju et al. (2010) reported that common well pad densities of four and eight pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below one pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding one well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (eight pads/section).

Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the “developed” covariate examined included urban and suburban areas, and interstate and state highways as classified by Landfire (2006) and was quantified within 1-km grid cells. Therefore the results may not be comparable to how the stipulations in the DEIS are forwarded.

The potential benefits of co-location or clustering infrastructure (a potential benefit of unitization as stipulated in Alternative B) of energy developments as described in Appendix AB may be noncompatible with the per-section surface disturbance thresholds as forwarded in Appendix C, where permitted disturbances are limited to one per section with no more than 5% surface disturbance in that section. Limiting disturbance to one well pad/infrastructure and 5% surface disturbance per section as established in the preferred alternative, unless quantified as an average across a larger landscape, will counteract and contradicts the requirement of clustering infrastructure. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al.

(2007) found that gas development—measured as the proportion of area around a lek within 350 m of the infrastructure of a gas field—within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities.

Recommendation for Fluid Minerals

- **Retain stipulations contained in the preferred alternative regarding the 4-mile buffer in PPAs.** Given the process for delineating PPAs in Montana, **the 4-mile NSO buffer, contained within the preferred alternative, is supported by the scientific literature**. However, modifications to the boundaries delineated by the 4-mile buffer may have resulted in PPA boundaries being relatively close to leks and/or other seasonal habitats. **Consider including all areas, regardless of habitat designation, within 2 to 4 km of a lek NSO for lower activity sites (e.g., producing well pads) and all areas within 6 to 6.4 km of a lek NSO for higher activity sites (e.g., drilling rigs). Additionally consider restricting fluid mineral development in all areas, regardless of habitat designation, within 2 km of winter range and within 1 km of nesting habitats.** These suggestions are in addition to the NSO stipulation forwarded in the preferred alternative. Alternative B does not provide language analogous to these suggestions.
- **Adopt Alternative B stipulations for management of RAs and GHAs because a 0.6-mile buffer as outlined in the preferred alternative will not eliminate indirect effects of energy development to lek habitat integrity.**
- **Implement the timing restrictions in RAs and GHAs within 4 miles of a lek** to encompass a majority of the nesting population, as stipulated under Alternative B. Seasonal timing restrictions have been found ineffective, especially given that timing restrictions do not apply to the operation and maintenance of production facilities. **Minimization of human activity at infrastructure placed within seasonally protected areas** may represent a management alternative to enforcing an NSO. For example, Appendix AB ("Mitigation Measures and Conservation Actions for Greater Sage-grouse Habitat") lists the following as BMPs for fluid mineral development: "establish trip restrictions or minimization through use of telemetry and remote well control" and "place liquid gathering facilities outside of priority areas." Requiring these practices when developing fluid minerals in priority areas could reduce human activity levels in these areas.
- **Establish the surface disturbance threshold, if one is to be applied in the preferred alternative, as the proportion of area disturbed by a metric that can be directly related to infrastructure density**. For example, one average-size well pad plus access road directly influences a given number of acres that can be divided by 640 to establish a surface disturbance threshold that is directly relevant to the density threshold of one well pad/section reported in the literature. Research suggests that the co-location or clustering of infrastructure reduces impacts of energy development to sage-grouse by reducing the proportion of a landscape indirectly influenced by that infrastructure. Thus, surface disturbance thresholds should be calculated across a larger area than 1 square mile to allow for clustering of infrastructure while maintaining the average one pad/section and surface disturbance threshold.

Vegetation: Rangelands

Summary of the DEIS for Vegetation: Rangelands

The preferred alternative allows for a variety of treatment methods—including prescribed fire—to be used for treating sagebrush communities. Alternative B does not allow prescribed fire in sagebrush communities.

Analysis of Vegetation: Rangelands

The Sage and Columbian Sharp-tailed Grouse Technical Committee (2009) suggest that the scientific evidence supporting the use of prescribed fire for sage-grouse conservation is scant, while considerable information documenting negative effects of fire on sage-grouse exists. The authors recommend avoiding the use of prescribed fire in xeric sagebrush habitats. Fischer et al. (1996) reported that the abundance and biomass of ants was reduced the second and third years after treatment. Nelle et al. (2000) reported a significant increase in ant and beetle abundance one year post-treatment, but abundance levels had returned to untreated levels within three to five years. Slater (2003) reported no difference in abundance or biomass between treated and untreated sites. These results suggest treatments may have limited utility as a tool for sage-grouse brood-rearing habitat management. Slater (2003) also reported no difference in nest success probabilities within and outside burn boundaries (35% vs. 20%, respectively). Overall nest success in his study (24%) was very low, suggesting potential impacts to nest success at spatial scales larger than actual treatments. Nelle et al. (2000) reported that prescribed fire negatively affected habitat conditions for sage-grouse nesting and brood-rearing up to 15 years post-burn. Beck et al. (2009), after investigating the impact to wintering, nesting, and early brood habitat 14 years post-burn, concluded managers should not consider prescribed fire in xeric sagebrush habitats.

Recommendation for Vegetation: Rangelands

- **Do not include prescribed fire as a tool for treatments meant to improve habitat conditions for sage-grouse in areas where fire is not being used to specifically target range issues (e.g., cheatgrass)**. **Alternative B is supported by the scientific literature.**

Note that in the Vegetation: Rangelands section, Alternative B allows for prescribed fire to be used to eliminate conifer encroachment and to stimulate vegetative re-growth in grassland/shrubland habitats. This may contradict the stipulation under Alternative B where prescribed fire is not allowed in sagebrush communities.

Vegetation: Riparian and Wetlands

Summary of DEIS for Vegetation: Riparian and Wetlands

The preferred alternative stipulates an NSO buffer of 300 feet around riparian areas and wetlands, water bodies, perennial streams, and floodplains of perennial streams, a quarter-mile NSO around reservoirs with fish, and a half-mile NSO around “Blue Ribbon” streams for oil and gas development infrastructure. These habitats represent potential late brood-rearing areas for sage-grouse.

Although there is no literature specific to indirect effect-distances of the infrastructure of oil and gas developments on sage-grouse summering habitats, distance-effects from other seasonal periods suggest these distances may not be sufficient if a goal of the NSO stipulations are to maintain summer use of these areas by sage-grouse.

Recommendation for Vegetation: Riparian and Wetlands

- **Support a NSO of 1 to 2 km for seasonal ranges, as current research supports,** if one of the goals of NSOs around mesic areas stipulated in the preferred alternative is to minimize negative impacts of energy development on sage-grouse during late brood-rearing (rather than, for example, maintaining riparian habitat integrity as the only goal of these NSOs).

<u>Livestock Grazing</u>

Summary of DEIS for Livestock Grazing

The preferred alternative, although reliant on site-specific plans not provided or yet to be developed to establish management direction, would prioritize allotments for evaluation that are not meeting standards of rangeland health. Alternative B does not differ from the preferred alternative.

Analysis of Livestock Grazing

Management of sagebrush habitats for sage-grouse in the context of state-and-transition theories (e.g., ecological site capabilities) is a function of both long-term management to promote desirable plant communities and species composition and growth, and annual management of the standing crop to provide cover for sage-grouse (Cagney et al. 2010). Managing solely for the capabilities of an ecological site addresses some but not all of the sagebrush habitat management issues. The potential exists to manage a site for long-term stability within the reference community but fail to achieve sage-grouse habitat objectives. For example, late season and winter livestock use of a site may provide for long-term resilience of the site in the reference state but fail to provide sufficient hiding cover for sage-grouse. Sage-grouse initiate nesting prior to the production of the current year's standing crop of herbaceous vegetation, and as such, residual grasses left from the previous year represent the initial cover available for nesting sage-grouse (Cagney et al. 2010).

Recommendation for Livestock Grazing

- **Include sage-grouse-specific metrics and indicators as forwarded in the NTT report when assessing livestock grazing management needs.**

<u>Wildlife Habitat and Special Status Species (Wildlife)</u>

Summary of pertinent issues within the DEIS for Wildlife Habitat and Special Status Species (Wildlife)

The preferred alternative establishes that off-site compensatory mitigation would be applied as close to the affected area as possible. Additionally, water developments, "where deemed effective," would be managed to reduce the spread of West Nile virus.

Analysis of Identified Issues for Wildlife Habitat and Special Status Species (Wildlife)
As discussed above, the indirect effects of infrastructure—especially infrastructure with high levels of human activity—may be substantial. If mitigation projects are located within the target species' avoidance-distance of the activity that is being mitigated, then any benefit of the mitigation action to the target species would not be realized due to a lack of use of the site being enhanced.

Presently, sage-grouse lack resistance to WNv, and exposure to the virus results in 100% mortality (Clark et al. 2006). Given relationships among temperature, water and WNv, climate change, resulting in higher temperatures and drier summers in the western United States, as most models predict, these factors may increase impacts of WNv on sage-grouse populations.

Recommendation for Identified Issues for Wildlife Habitat and Special Status Species (Wildlife)

- **Add language to the mitigation stipulation indicating that off-site mitigation should be implemented in areas where the benefits of the mitigation have a good chance of influencing the wildlife previously using the area being mitigated, but where use of the mitigation project would not be negatively influenced by indirect effects of infrastructure and/or human activity.**
- **Require that all water developments, including those developed for livestock, are built and/or maintained to reduce larval habitats for *Cx. tarsalis* mosquitoes.**

<u>**Energy and Mineral Resources**</u>

Summary of the DEIS for Mineral Resources
The preferred alternative establishes that subsurface mining for coal may occur in PPAs and RAs, but infrastructure must be placed outside of PPA boundaries. Existing mineral material permits would be renewed with no increase in permit boundaries. Alternative B would close PPA to mineral materials and locatable minerals. No changes to locatable mineral permits were stipulated in the preferred alternative.

For recommendations, see comments in Fluid Minerals section.

<u>**Lands and Realty: Rights-of-Way, Leases, and Permits**</u>

Summary of the DEIS for Lands and Realty: Rights-of-Way, Leases, and Permits
The preferred alternative manages PPAs as avoidance areas for ROW. ROW would be allowed in RAs and GHAs if suitable sage-grouse habitat can be maintained. Anti-perching devices are listed in the preferred alternative as a means of maintaining habitat. Conversely, in Alternative B, PPAs are exclusion areas for ROW and RAs, and GHAs are avoidance areas for ROW. Exclusion areas are those where development is not allowed unless there is a legal requirement to allow such access; avoidance areas allow for some flexibility for development.

Analysis of Lands and Realty: Rights-of-Way, Leases, and Permits
Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggests that these structures may negatively influence sage-grouse habitat

selection and survival. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.2 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to a transmission line increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors as gas wells. See also discussion under ROW below. Other often-cited studies that may provide evidence of impacts of power lines on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data. Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within two years, but this study had a sample size of one lek. Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only two juvenile grouse were killed by running into power lines.

Slater and Smith (2008) reported that perch deterrents reduced the occurrence of corvids and raptors relative to a control (non-deterred) line but that perching was not entirely prevented. Lammers and Collopy (2007) found that perch deterrents reduced the probability of a raptor or corvid perching on a power pole and reduced the duration of perching, but they also reported that perching was not entirely prevented by perch deterrents. In contrast, Prather and Messmer (2010) found that perch deterrents were ineffective at reducing the number of perch-events of raptors and corvids.

Recommendation for Lands and Realty: Rights-of-Way, Leases, and Permits

- Include **the preferred alternative's stipulation for PPAs as an avoidance area** because of the inconclusive nature of current research**.**
- Stipulate that **RAs and GHAs be avoidance areas for ROW development, as contained in Alternative B.** Scientific evidence is suggestive enough to warrant this.
- Maintain **the option of changing sage-grouse habitats from avoidance to exclusion areas for ROW in the DEIS.** As research results become available, there may be increased support for establishing all sage-grouse habitat as exclusion areas for ROW.
- **Avoid substituting anti-perching devices for burial or elimination of power lines to maintain habitat** because perch-deterrents reduce but do not eliminate perching on power poles by raptors and corvids,

Renewable Energy

Summary of DEIS for Renewable Energy

PPAs, RAs, GHAs, and sage-grouse winter range are considered avoidance areas for renewable energy exploration and facility development in the preferred alternative. In contrast Alternative B establishes PPAs, RAs and GHAs as exclusion areas for commercial renewable energy exploration and facility development.

LeBeau et al. (*in press*) reported that the risk of a nest or a brood failing decreased by 7.1% and 38.1%, respectively, with every 1-km increase in distance from the nearest wind turbine. No variation in female survival was detected relative to wind energy infrastructure (LeBeau et al. *in press*).

Recommendation for Renewable Energy

Maintain the option of changing sage-grouse habitats from avoidance to exclusion areas for commercial renewable energy in the DEIS. Yet, because of the lack of directly pertinent research, **the stipulations for sage-grouse habitats outlined in the preferred alternative are supported.** As research results become available, there may be increased support for establishing sage-grouse habitat as exclusion areas for commercial renewable energy developments.

Wild Horses

Summary of the DEIS for Wild Horses

Management to increase forage availability for wild horses would be maximized under the preferred alternative. In contrast, Alternative B establishes that no proactive habitat management would occur in wild horse habitats.

Analysis for Wild Horses

A horse consumes 20-65% more forage than would a cow of equivalent body mass due to physiological differences between the species (Connelly et al. 2004). Comparing horse-removed sites to horse-occupied sites, the following changes to sagebrush communities have been noted as a result of grazing by horses: reduced total vegetative and grass abundance and cover; lower sagebrush canopy cover; increased fragmentation of shrub canopies; lower species richness; increased compaction in surface soil horizons; and increased dominance of unpalatable forbs (Beever and Aldridge 2011). Additionally, because horses often segregate elevationally from, and use steeper slopes than cattle, horse occupancy of a sagebrush ecosystem reduces the occurrence of ungrazed areas (Connelly et al. 2004).

Recommendation for Wild Horses

- **Actively manage wild horse herds at a level where impacts of horse grazing do not negatively influence the quality of sage-grouse habitats.**

HiLine (MT) Draft RMP/EIS

General Observation

The potential effectiveness of the preferred alternative is dependent to a large degree on site-specific assessments, and the determination of suitable management actions based on these assessments, yet to be completed or otherwise not available. The primary examples include: management of development of leased fluid minerals, management of fluid mineral development in nesting habitat in general habitats, livestock grazing management, management of noxious weeds, and travel management. The DEIS references Appendix M ("Mitigation Measures and Conservation Actions for Greater Sage-grouse Habitat"), which includes many of the management recommendations forwarded in the NTT report, as required land-use actions for the issues listed below.

Fluid Minerals—Unleased

Summary of DEIS for Fluid Minerals—Unleased

The preferred alternative allows for fluid mineral leasing in PPAs, but with a NSO stipulation. Essentially, under the preferred alternative, fluid minerals can be leased in PPAs but must be accessed from infrastructure placed outside of PPA boundaries. The preferred alternative allows leasing in nesting habitats in general habitat with Controlled Surface Use (CSU) that essentially requires the generation of a site-specific management plan that would result in the maintenance of sage-grouse habitat functionality. The preferred alternative establishes that winter range would be under a timing stipulation that closes these areas to development between Dec. 1 and March 31, and a 1-mile no lease buffer around leks in general habitat. These differ from Alternative B—the alternative in the DEIS most closely aligned with the recommendations forwarded in the NTT report—in that Alternative B closes PPAs, nesting habitats in general habitat, and winter range to fluid mineral leasing, and establishes a 2-mile no lease buffer around leks in general habitats. PPA in Montana was initially delineated by buffering leks and lek complexes by 4 miles and generating polygons of those merged buffers that included large proportions of males based on 2005-07 lek counts (see Doherty et al. 2011); these initial polygons were then refined based on local knowledge.

Analysis of Fluid Minerals—Unleased

Other than the seasonal timing restriction actions forwarded under the preferred alternative, the potential indirect effects of infrastructure on sage-grouse were not addressed. Several authors have reported a distance-effect associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek, with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts on lekking sage-grouse of well pads located closer to leks were more consistently observed across energy fields compared to well pads farther away, with a consistent pattern whereby the presence of well pads within smaller radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks, compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development on the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species. Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year) the more likely it was to fail.

Research relevant to the efficacy of 1-mile no-lease buffer is not available. However, leks that had at least one well pad within 0.4 km (0.25 miles) had 35% to 92% fewer sage-grouse compared to leks with no well pads within this radii (Harju et al. 2010). Walker et al. (2007) reported that implementing a 0.4-km NSO given full field development within the remainder of a 0.8-km- or 3.2-km-radius area would result in lek persistence probabilities of 5% and 24%, respectively.

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse during the winter avoiding the infrastructure of a gas field during the day, but not at night. This suggests that avoidance was of human activity rather than the infrastructure itself. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period. Traffic levels were not measured but increased levels were inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig. These studies would suggest timing restrictions may be effective if human activity around infrastructure in or near seasonal ranges is eliminated or minimized.

Recommendation for Fluid Minerals—Unleased

- **Adopt the 4-mile NSO buffer for PPAs, contained in the preferred alternative**. This stipulation **is supported by the scientific literature.** However, modifications to the boundaries delineated by the 4-mile buffer may have resulted in PPA boundaries being relatively close to leks and/or other seasonal habitats. **Consider including all areas, regardless of habitat designation, within 2 to 4 km of a lek NSO for lower activity sites (e.g., producing well pads) and all areas within 6 to 6.4 km of a lek NSO for higher activity sites (e.g., drilling rigs). Additionally consider restricting fluid mineral development in all areas, regardless of habitat designation, within 2 km of winter range and within 1 km of nesting habitats.** These suggestions are in addition to the NSO stipulation forwarded in the preferred alternative. Alternative B does not provide language analogous to these suggestions.

- **Minimize human activity at infrastructure placed within seasonally protected areas** as a potential management alternative to enforcing an NSO. Although seasonal timing restrictions are stipulated in the preferred alternative, **recommendations forwarded in the literature as well as the NTT report suggest seasonal timing restrictions are ineffective**, especially relevant here as timing restrictions do not apply to operation and maintenance of production facilities. Appendix M (*Mitigation Measures and Conservation Actions for Greater Sage-grouse Habitat*) lists the following as BMPs for fluid mineral development: "establish trip restrictions or minimization through use of telemetry and remote well control" and "place liquid gathering facilities outside of priority areas." Requiring these practices when developing fluid minerals in priority areas could reduce human activity levels in these areas.

Fluid Minerals—Leased

Summary of DEIS for Fluid Minerals—Leased

The preferred alternative allows for development of leased fluid minerals in sage-grouse habitat, but existing leases must be managed according to Best Management Practices (BMPs as forwarded in Appendix E.2). Alternative B did not differ from the preferred alternative in these instances. The BMPs listed include: a 0.6-mile NSO around existing surface disturbance in PPA and general habitats, which essentially represents a technique for limiting surface disturbance to one disturbance per square mile; a 1-mile avoidance buffer around leks in general habitats; timing stipulations in winter range; and the need to generate a site-specific management plan that includes mitigation of impacts. Although included in the Vegetation—Rangeland section of the DEIS, Alternative B stipulates no more than 3% anthropogenic surface disturbance in PPA.

Analysis of Fluid Minerals—Leased

Substantial amounts of research suggest that reducing infrastructure densities around leks will benefit sage-grouse. Harju et al. (2010) reported that common well pad densities of 4 and 8 pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below one pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding one well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks

(>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (8 pads/section).

However, the technique used to limit surface disturbance by establishing an NSO around existing disturbance may result in development occurring at low densities across much of the landscape. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al. (2007) found that gas development—measured as the proportion of area around a lek within 350 m of the infrastructure of a gas field—within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities.

Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the "developed" covariate examined included urban and suburban areas, and interstate and state highways as classified by Landfire (2006) and was quantified within 1-km grid cells. Therefore, the results may not be comparable to how the stipulations in the DEIS are forwarded.

Recommendation for Fluid Minerals—Leased

- **Include management prescriptions contained with Appendix E.2—BMPs—within the RMP itself**.
- **Calculate infrastructure density thresholds across a larger area than 1 square mile to allow for clustering of infrastructure while maintaining an average of one pad/section**. Research supports the minimization of energy development infrastructure densities to one per section averaged across an area designated by a 3- to 3.2-km radius.
- **Include language that allows for and encourages the clustering or co-locating of infrastructure on the landscape.** Research suggests that the co-location or clustering of infrastructure reduces impacts of energy development to sage-grouse by reducing the proportion of a landscape indirectly influenced by that infrastructure. It is worth noting that the 3% anthropogenic surface disturbance threshold prescribed in Alternative B, if calculated at the scale of a square mile as suggested in the NTT report, will not alleviate the need to address co-location.

<u>Rights-of-Way (ROWs)</u>

Summary of the DEIS for ROWs

The preferred alternative makes PPAs ROW avoidance areas. In contrast, PPAs are exclusion areas in Alternative B.

Analysis of ROWs

Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggests that these structures may negatively influence sage-grouse habitat selection and survival. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.20 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission line increased. It is worth noting that the author found brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, the distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors as gas wells. See also discussion under rights-of-way below. Other often cited studies that may provide evidence of impacts of power lines on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data. Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within 2 years, but this study had a sample size of one lek. Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only 2 juvenile grouse were killed by running into power lines.

Recommendation for ROWs

- **Maintain the option of changing sage-grouse habitats from avoidance to exclusion areas in the DEIS.** Because of the inconclusive nature of current research, the **stipulations outlined in the preferred alternative may be sufficient**. However, as research results become available, there may be increased support for establishing all sage-grouse habitat as exclusion areas for ROWs as stipulated under Alternative B.

<u>Livestock Grazing</u>

Summary of the DEIS for Livestock Grazing

The preferred alternative, although reliant on site-specific plans not provided or yet to be developed to establish management direction, indicates that standards for rangeland health will meet or exceed proper functioning condition. Alternative B does not differ from the preferred alternative.

Analysis of Livestock Grazing

Management of sagebrush habitats for sage-grouse in the context of state-and-transition theories (e.g., ecological site capabilities) is a function of both long-term management to promote desirable plant communities and species composition and growth, and annual management of the standing crop to provide cover for sage-grouse (Cagney et al. 2010). Managing solely for the capabilities of an ecological site addresses some but not all of the sagebrush habitat management issues. The potential exists to manage a site for long-term stability within the reference community but fail to achieve sage-grouse habitat objectives. For example, late season and winter livestock use of a site may provide for long-term resilience of the site in the reference state but fail to provide sufficient hiding cover for sage-grouse. Sage-grouse initiate nesting prior to the production of the current year's standing crop of herbaceous vegetation, and as such, residual grasses left from the previous year represent the initial cover available for nesting sage-grouse (Cagney et al. 2010).

Recommendation for Livestock Grazing

- **Include sage-grouse specific metrics and indicators as forwarded in the NTT report for assessing livestock grazing management needs.**

<u>**Vegetation—Rangeland**</u>

Summary of DEIS for Vegetation—Rangeland

The preferred alternative establishes that only vegetation treatments that conserve, enhance or restore sage-grouse habitat would be allowed. Additionally, rest from livestock following treatment may be less than 2 growing seasons if situations warrant. Alternative B did not differ from the preferred alternative.

Analysis of Vegetation—Rangeland

Although the premise of the stipulation forwarded in the preferred alternative that only treatments that conserve, enhance or restore sage-grouse habitat be allowed is on the surface sound, the enhancement or restoration of sagebrush-habitats is not a trivial task. There is tremendous uncertainty as to the vegetative and sage-grouse population outcomes of habitat manipulations (Johnson and Holloran 2010). Managers often justify habitat manipulations with potential long-term benefits, but the long-term effects of most of the available habitat manipulation options to habitats and consequences to sage-grouse are unknown. Extreme caution and discretion should be employed when proposing a habitat treatment, especially on drier sites, sites where cheatgrass may invade, and sites with limited potential to produce sagebrush (e.g., the interface between the Wyoming Basin and the Great Plains; Cagney et al. 2010). This is not to say efforts should not be initiated to address habitat degradation—as habitat degradation is a significant causal factor in sage-grouse declines (see Connelly et al. 2004). A conservative approach to proactive habitat manipulations is warranted as we do not have all or even many of the answers when it comes to improving sagebrush habitat conditions for sage-grouse. Although mitigation plans should be developed at landscape spatial scales, development at this scale does not necessitate that treatments be implemented across these scales. A small-scale, case-by-case treatment regime conducted over the long term should be implemented. Connelly et al. (2000)—in the sage-grouse habitat management guidelines—recommend that no more than 20% of the nesting, early brood-rearing and wintering habitats (in combination) in a landscape be in a treated state at any one time; recovery from treatment should be considered ≥12% canopy cover in Wyoming big sagebrush and ≥15% in mountain big sagebrush-dominated areas.

Stipulating rest from livestock for ≤2 years post-treatment may not be sufficient in some cases. Knick et al. (2011) contend that the reintroduction of livestock to a treated area prior to the native or reseeded plant community becoming established, regardless of the number of years of rest afforded the site, can result in failed rehabilitation efforts and increased levels of exotic grasses. Bates et al. (2009) suggest that timing, intensity and duration of grazing treated habitats may be more important than a specific period of rest following a fire.

Recommendation for Vegetation—Rangeland

- **Add language to the preferred alternative establishing the uncertainty surrounding enhancement of sagebrush habitats with treatment**. Additionally, consider adding **a region-wide habitat management plan that addresses site-specific actions in the context of the landscape as an appendix** to the DEIS. The plan needs to be generated from an analysis of all available information, include projections of the vegetative and sage-grouse population response to potential management actions, outline specific pre- and post-treatment monitoring requirements, and should set in motion a process whereby data from implemented actions are used to inform future actions in an iterative cycle where mitigation actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The adaptive context established by a mitigation plan iteratively evaluated is extremely important given the uncertainty surrounding sagebrush habitat management.
- **Dictate the length of post-treatment rest from livestock on a treatment-by-treatment basis based on a site moving towards the intended objectives of the treatment,** not 2 years or less.
- **Require that all water developments, including those developed for livestock, are built and/or maintained to reduce larval habitats for Cx. tarsalis mosquitoes.** There was no mention in the DEIS of development standards for water sources for livestock, although BMPs were forwarded in the fluid minerals appendix. Currently, sage-grouse lack resistance to WNv, and exposure to the virus results in 100% mortality (Clark et al. 2006). Most climate models predict higher temperatures and drier summer conditions in the western U.S., which may increase impacts of WNv on sage-grouse populations.

<u>Fire Management and Ecology</u>

Summary of DEIS for Fire Management and Ecology

The preferred alternative maintains fire as a management option for treatment of habitats. Alternative B did not differ from the preferred alternative.

Analysis of Fire Management and Ecology

The Sage and Columbian Sharp-tailed Grouse Technical Committee (2009) suggest that the scientific evidence supporting the use of prescribed fire for sage-grouse conservation is scant while considerable information documenting negative effects of fire on sage-grouse exists. The authors recommend avoiding the use of prescribed fire in xeric sagebrush habitats. Beck et al.

(2009), after investigating the impact to wintering, nesting, and early brood habitat 14 years post-burn, concluded managers should not consider prescribed fire in xeric sagebrush habitats; it is worth noting that both the preferred alternative and Alternative B do not allow the use of fire to treat sagebrush in low precipitation zones.

Recommendation for Fire Management and Ecology

- **Do not include prescribed fire as a tool for treatments meant to improve habitat conditions for sage-grouse in areas where fire is not being used to specifically target range issues (e.g., cheatgrass)**, as is recommended in the NTT report.

<u>Solid Mineral Development</u>

The preferred alternative allows for the leasing of PPA for solid mineral development, the continuation of the development of existing leases for salable minerals and locatable minerals, but closes PPA to leasable mineral development. This differs from Alternative B in that in this alternative PPA is closed to solid mineral leasing, and closed to the development of salable minerals.

The literature review and recommendations forwarded under leased and unleased fluid minerals are pertinent here.

Lewistown (MT) Draft RMP/EIS

General Comment

The administrative flexibility and subjectivity built into several of the stipulations forwarded under the preferred alternative negates the regulatory mechanisms presented for those stipulations. For example, COAs for the development of fluid minerals can be waived by the authorized officer given "acceptable" levels of mitigation. These potential loopholes to prescribed management approaches should be eliminated from the preferred alternative.

Fluid Minerals—Leased

Summary of DEIS for Fluid Minerals—Leased

The preferred alternative establishes that surface-disturbing and disruptive activities would be avoided or minimized in sage-grouse habitats. Noise related to long-term operations or activities would be limited to no greater than 32 dBA at the perimeter of leks and seasonal habitats. The preferred alternative differs from Alternative B—the alternative in the DEIS aligned with the recommendations forwarded in the NTT report—in that Alternative B allows no new surface occupancy in Priority sage-grouse Habitats (PH) including winter concentration areas with the following exception: for leases entirely within PH, a 4-mile NSO around leks is stipulated and surface disturbance is limited to one per section with no more than 3% surface disturbance in that section. Alternative B also requires unitization when deemed necessary. PH in MT was initially delineated by buffering leks and lek complexes by 4 miles and generating polygons of those merged buffers that included large proportions of males based on 2005-07 lek counts (see Doherty et al. 2011); these initial polygons were then refined based on local knowledge.

Both alternatives stipulate that Required Design Features (RDFs; Appendices C and D) would be implemented in PH (the preferred alternative and Alternative B) and GH (preferred alternative) as mandatory COAs. RDFs listed for the preferred alternative pertinent to the development of fluid minerals: result in reduced speeds and vehicle activity levels within developments located in PH or GH; result in clustered infrastructure within PH and GH; result in infrastructure being placed within disturbed areas in PH and GH; and result in liquid gather facilities and other high activity infrastructure (e.g., compressor stations) being placed outside of PH and GH boundaries. Exceptions to the mandatory COAs applied to existing leases in PH and GH may be granted by the authorized officer if it is demonstrated that effects could be mitigated to an acceptable level.

It is worth noting the unleased fluid minerals were not addressed in the DEIS.

Analysis of Fluid Minerals—Leased

By not stipulating a well density or distance threshold, the preferred alternative does not mandate actions that would limit disturbance from fluid mineral development to sage-grouse other than the RDFs resulting in high activity infrastructure being placed outside of sage-grouse habitats. Several authors have reported a "distance-effect" associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek, with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts to lekking sage-grouse of well pads located at shorter distances to leks were more consistently observed across energy fields compared to well pads at longer distances, with a consistent pattern whereby the presence of well pads within smaller radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development to the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species.

Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

Substantial amounts of research is available suggesting that reducing infrastructure densities around leks will benefit sage-grouse. However, no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Harju et al. (2010) reported that common well pad densities of 4 and 8 pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below one pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding one well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (8 pads/section).

Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the “developed” covariate examined included urban and suburban areas, and interstate and state highways as classified by Landfire (2006) and was quantified within 1-km grid cells. Therefore, the results may not be comparable to how the stipulations in the DEIS are forwarded.

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse during the winter avoiding the infrastructure of a gas field during the day, but not at night. This suggests that avoidance was of human activity rather than the infrastructure itself. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period. Traffic levels were not measured but increased levels were inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig. These studies would suggest timing restrictions may be effective if human activity around infrastructure in or near seasonal ranges is eliminated or minimized.

Unitization provides for the exploration, development, and operation of a geologically defined area by a single operator making phased and/or clustered development more tenable. Unitization may benefit sage-grouse by resulting in the co-location or clustering of infrastructure of energy development—as included as an RDF in the preferred alternative. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al. (2007) found that gas development—measured as the proportion of area around a lek within 350 m of the infrastructure of a gas field—within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities.

Although the premise forwarded in the preferred alternative that COAs would be waived if mitigated is on the surface sound, the enhancement or restoration of sagebrush habitats is not a trivial task. There is tremendous uncertainty as to the vegetative and sage-grouse population outcomes of habitat manipulations (Johnson and Holloran 2010). Managers often justify habitat manipulations with potential long-term benefits, but the long-term effects of most of the available habitat manipulation options to habitats and consequences to sage-grouse are unknown. Extreme caution and discretion should be employed when proposing a habitat treatment, especially on drier sites, sites where cheatgrass may invade, and sites with limited potential to produce sagebrush (e.g., the interface between the Wyoming Basin and the Great Plains; Cagney et al. 2010). Some treatments may be prudent to address habitat degradation because habitat degradation is a significant causal factor in sage-grouse declines (see Connelly et al. 2004). However, a conservative or limited approach to proactive habitat manipulations is warranted because we do not have all, or even many, of the answers when it comes to improving sagebrush habitat conditions for sage-grouse. Although mitigation plans should be developed at landscape spatial scales, development at this scale does not necessitate that treatments be implemented across these scales. A small-scale, case-by-case treatment regime conducted over the long term should be implemented. Connelly et al. (2000)—in the sage-grouse habitat management guidelines—recommend that no more than 20% of the nesting, early brood-rearing and wintering habitats (in combination) in a landscape be in a treated state at any one time; recovery from treatment should be considered ≥12% canopy cover in Wyoming big sagebrush and ≥15% in mountain big sagebrush-dominated areas.

Recommendation for Fluid Minerals—Leased

- **Adopt stipulations in Alternative B, which are generally supported by the scientific literature**. In the preferred alternative, given the RDF that high activity infrastructure needs to be placed outside of PH and GH boundaries, along with the process used for delineating PH in Montana (i.e., a 4-mile buffer around leks), indirect effects of high activity energy development infrastructure to sage-grouse on leks should in general be minimized. However, impacts from other infrastructure were not addressed in the preferred alternative. Current research supports the inclusion in the preferred alternative of **a 2 to 4 km NSO buffer around leks for lower activity sites (e.g., producing well pads); the NSO buffer should be maintained across differing habitat designations** (i.e., not clipped to the boundary of PH or GH but maintained at 2 to 4 km regardless of habitat designation). **Consider including all areas, regardless of habitat designation, within 6 to 6.4 km of a lek NSO for higher activity sites (e.g., drilling rigs). Additionally consider restricting fluid mineral development in all areas, regardless of habitat designation, within 2 km of winter range and within 1 km of nesting habitats.** These considerations are in addition to the RDF forwarded in the preferred alternative where high activity infrastructure needs to be placed outside of PH and GH boundaries. It is worth noting that the RDF resulting in infrastructure being placed within disturbed sage-grouse habitats does not address the potential indirect effects to sage-grouse of that infrastructure; implementation of NSOs as suggested in bold above would address this concern.
- **Minimize energy development infrastructure densities to one per section averaged across an area designated by a 3- to 3.2-km radius**. A consistently applied surface disturbance threshold is not supported in the literature. If a surface disturbance threshold is to be applied in the preferred alternative, it is recommended that the

threshold be established as the proportion of area disturbed by a metric that can be directly related to infrastructure density. For example, one average sized well pad plus access road directly influences a given number of acres that can be divided by 640 to establish a surface disturbance threshold that is directly relevant to the density threshold of one well pad/section reported in the literature.

- **Require the co-location or clustering of infrastructure to reduce impacts of energy development to sage-grouse** and reduce the proportion of a landscape indirectly influenced by that infrastructure. **If unitization consistently results in clustered infrastructure, it should be required as presented in Alternative B**.
- **Reconcile the potential contradiction between a per-section surface disturbance threshold and unitization that clusters infrastructure in smaller areas**. The potential benefits of unitization (i.e., the co-location or clustering infrastructure of energy developments in PH—also presented as an RDF) may be noncompatible with the per section surface disturbance thresholds as forwarded in Alternative B where permitted disturbances are limited to "one per section with no more than 3% surface disturbance in that section."
- **Minimize human activity at infrastructure placed within seasonally protected areas**. Although seasonal timing restrictions are stipulated in the preferred alternative, recommendations forwarded in the literature as well as the NTT report suggest seasonal timing restrictions are ineffective. For example, the RDFs resulting in liquid gather facilities and other high activity infrastructure (e.g., compressor stations) being placed outside of PH and GH boundaries could reduce human activity levels in priority areas. Additionally, to encompass a majority of the nesting population, **a 4-mile lek buffer is required for implementation of timing restrictions**.
- **Add language to the preferred alternative establishing the uncertainty surrounding enhancement of sagebrush habitats with treatment.** Additionally, consider adding **a region-wide habitat management plan that addresses site-specific actions in the context of the landscape as an appendix** to the DEIS. The plan needs to be generated from an analysis of all available information, include projections of the vegetative and sage-grouse population response to potential management actions, outline specific pre- and post-treatment monitoring requirements, and should set in motion a process whereby data from implemented actions are used to inform future actions in an iterative cycle where mitigation actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The adaptive context established by a mitigation plan iteratively evaluated is extremely important given the uncertainty surrounding sagebrush habitat management.

Travel Management

Summary of DEIS for Travel Management

The preferred alternative allows for the upgrading of existing routes that would change route category (road, primitive road, or trail). These upgrades would not be allowed under Alternative B. Additionally, discussed here are the RDFs managing vehicle speeds and volumes.

Analysis of Travel Management

Restrictions on speeds and volume of vehicle traffic on roads in sage-grouse habitats as a means of reducing the impacts of roads to sage-grouse are supported management actions. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period. Traffic speed was not measured but the potential for increased speed was inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes and that vehicle activity on roads within 3 km of leks during the time of day sage-grouse were present on leks influenced the number of males on leks more negatively than leks where roads within 3 km had no vehicle activity during the strutting period. Lyon and Anderson (2003) reported that traffic disturbance (1 to 12 vehicles/day) within 3 km of leks during the breeding season reduced nest-initiation rates and increased distances moved from leks during nest site selection of female sage-grouse breeding on those leks. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig.

Recommendation for Travel Management

- **Consider speed limits and management that minimizes traffic on roads within 3 km of active leks, as research suggests. However, the stipulation forwarded under Alternative B restricting the upgrade of roads may be an appropriate management action that maintains traffic levels and speeds at current levels**. The upgrade of roads as allowable under the preferred alternative could result in increased traffic volumes and speeds.
- **Require sound abatement modifications to vehicles being used in energy developments to reduce the impact of road noise on breeding sage-grouse**.

<u>Rights-of-Way (ROW)</u>

Summary of DEIS for ROWs

The preferred alternative makes PH right-of-way (ROW) avoidance areas; ROWs would be allowed in GH with appropriate mitigation and conservation measures (perch deterrents specifically mentioned in Appendix D). In contrast, PHs are exclusion areas and GHs are avoidance areas for ROWs in Alternative B.

Analysis of ROWs

Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggests that these structures may negatively influence sage-grouse habitat selection and survival. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.20 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission line increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors as gas wells. See also discussion under rights-of-way below. Other often cited studies that may provide evidence of impacts of power lines on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data. Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within 2 years, but this study had a sample size of one lek. Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only 2 juvenile grouse were killed by running into power lines.

Slater and Smith (2008) reported that perch deterrents reduced the occurrence of corvids and raptors relative to a control (non-deterred) line, but that perching was not entirely prevented. Lammers and Collopy (2007) found that perch deterrents reduced the probability of a raptor or corvid perching on a power pole and reduced the duration of perching, but they also reported that perching was not entirely prevented by perch deterrents. In contrast, Prather and Messmer (2010) found that perch deterrents were ineffective at reducing the number of perch-events of raptors and corvids.

Recommendation for ROWs

- **Consider the option of changing PH from avoidance to exclusion areas.** Because of the inconclusive nature of current research, **the stipulations for PH outlined in the preferred alternative may be sufficient.** However, as research results become available, there may be increased support for establishing all sage-grouse habitat as exclusion areas for ROWs.
- **Adopt stipulations in Alternative B for ROW development in GH.**
- **Avoid substituting anti-perching devices for burial or elimination of power lines to maintain habitat** because perch-deterrents reduce but do not eliminate perching on power poles by raptors and corvids. Anti-perching devices should only be considered where burial is not an option.

Solid Minerals—Coal

The preferred alternative allows for coal exploration and mining in sage-grouse habitats with seasonal timing restrictions placed on development activity in nesting and winter habitats (as established as an RDF in Appendix D). Alternative B would close PH to surface coal mining; close PH to new subsurface coal mining leases unless all appurtenant facilities are placed outside of PH boundaries; require that appurtenant facilities are placed outside of PH boundaries or within already disturbed habitats within PH; and minimize mining disturbance in GH.

The information and recommendations presented under the review of fluid minerals is relevant here.

Locatable, Non-energy Leasable, and Salable Minerals

The preferred alternative allows for the development of locatable, non-energy leasable, and salable minerals in sage-grouse habitats. Alternative B closes PH to these activities.

The information and recommendations presented under the review of fluid minerals is relevant here.

Fire

Summary of DEIS for Fire

The preferred alternative does not restrict the use of prescribed fire in sage-grouse habitats, but states that: “sites should not be burned unless: biological and physical limitations of the site and impact on greater sage-grouse are identified and determined to be neutral or beneficial to PH, including moisture regimes, soil texture, seed sources, and sagebrush recovery time.” In contrast, Alternative B would not allow the use of prescribed fire to treat sagebrush in xeric habitats (<12-in precipitation zones).

Analysis of Fire

The Sage and Columbian Sharp-tailed Grouse Technical Committee (2009) suggest that the scientific evidence supporting the use of prescribed fire for sage-grouse conservation is scant while considerable information documenting negative effects of fire on sage-grouse exists. The authors recommend avoiding the use of prescribed fire in xeric sagebrush habitats. Fischer et al. (1996) reported that the abundance and biomass of ants was reduced the second and third years after treatment. Nelle et al. (2000) reported a significant increase in ant and beetle abundance one year post-treatment, but abundance had returned to untreated levels within 3 to 5 years. Slater (2003) reported no difference in abundance or biomass between treated and untreated sites. These results suggest treatments may have limited utility as a tool for sage-grouse brood-rearing habitat management. Slater (2003) reported no difference in nest success probabilities within and outside burn boundaries (35 vs. 20% respectively). Overall nest success in his study (24%) was very low, suggesting potential impacts to nest success at spatial scales larger than actual treatments. Nelle et al. (2000) reported that prescribed fire negatively affected habitat conditions for sage-grouse nesting and brood rearing up to 15 years post-burn. Beck et al. (2009), after investigating the impact to wintering, nesting, and early brood habitat 14 years post-burn, concluded managers should not consider prescribed fire in xeric sagebrush habitats.

Recommendation for Fire

- **Do not include prescribed fire as a tool for treatments meant to improve habitat conditions for sage-grouse in areas where fire is not being used to specifically target range issues (e.g., cheatgrass) as proposed in Alternative B**. It is worth noting that the inclusion of “moisture regimes” as a caveat to allowing fire as presented in the preferred alternative could be used to exclude the use of prescribed fire in xeric sagebrush systems.

Trees

Summary of DEIS for Trees

In appendix D, the preferred alternative establishes an RDF that would require the removal of trees within 100 m of occupied sage-grouse leks and other habitats; the same RDF was presented for Alternative B (Appendix C).

Analysis of Trees

Baruch-Mordo et al. (2013) found that the probability of lek persistence was lower in areas where conifers were dispersed throughout an area designated by a 1-km-radius buffer; with the probability of persistence approaching 0% at conifer canopy cover values >6% within this area. Miller et al. (2011) suggest that a relationship exists whereby sagebrush canopy cover declines below 15% when juniper cover exceeds approximately 12%, and that sagebrush canopy cover declines below 10% when juniper cover exceeds approximately 18%; the sage-grouse habitat management guidelines (Connelly et al. 2000) suggest that productive sage-grouse nesting habitat is characterized by sagebrush canopy cover exceeding 15%, and that productive brood-rearing and winter habitats are characterized by sagebrush canopy cover exceeding 130%. Doherty (2008) found that nesting sage-grouse avoided conifer-dominated habitats at 0.10 km.

Recommendation for Trees

- **Remove conifer trees within 1000 m of occupied leks**, especially in areas where trees are widely dispersed and tree canopy cover is approaching 6% within this area, as research suggests. Removal of trees from within 100 m of other seasonal habitats is supported in the literature.

Miles City (MT) Draft RMP/EIS

Fluid Minerals—Leasing

Summary of Fluid Minerals—Leasing

The preferred alternative allows for fluid mineral leasing in Protection Priority Areas (PPAs), but with a NSO stipulation. Essentially, under the preferred alternative, fluid minerals can be leased in PPA but must be accessed from infrastructure placed outside of PPA boundaries. The preferred alternative allows for fluid mineral leasing in RAs and GHAs with a CSU stipulation to maintain sage-grouse habitat and associated populations throughout RAs and within 2 miles of leks within GHAs. These differ from Alternative B—the alternative in the DEIS most closely aligned with the recommendations forwarded in the NTT report—in that Alternative B: closes PPA to fluid mineral leasing; allows leasing of GHAs with a CSU stipulation (maintain sage-grouse habitat and associated populations) within 4 miles of leks; and allows leasing of RAs with NSO in sections within 1 mile of a lek with 3 or fewer wells and a CSU stipulation (maintain sage-grouse habitat and associated populations) in sections with 4 or more wells. PPA in MT was initially delineated by buffering leks and lek complexes by 4 miles and generating polygons of those merged buffers that included large proportions of males based on 2005-07 lek counts (see Doherty et al. 2011); these initial polygons were then refined based on local knowledge.

Analysis of Fluid Minerals—Leasing

Several authors have reported a “distance-effect” associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek, with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts to lekking sage-grouse of well pads located at shorter distances to leks were more consistently observed across energy fields compared to well pads at longer distances, with a consistent pattern whereby the presence of well pads within smaller radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development on the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species. Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

If the CSU established around leks in GHA is meant to maintain breeding habitat associated with a lek, research supports designating a 4-mile buffer around leks. Approximately 80% of female sage-grouse nest within 4 miles of the lek where bred (Colorado Greater Sage-grouse Steering Committee 2008), whereas <50% of females nest within 2 miles of the lek where bred (Holloran and Anderson 2005).

Recommendation for Fluid Minerals—Leasing

- **Institute the stipulations for PPAs in the preferred alternative, which are generally supported by the scientific literature.** Given the process for delineating PPAs in Montana (e.g., a 4-mile buffer around leks), indirect effects of energy development to sage-grouse on leks should in general be minimized by the NSO stipulation forwarded in the preferred alternative. However, modifications to the boundaries delineated by the 4-mile buffer may have resulted in PPA boundaries being relatively close to leks and/or other seasonal habitats. **Consider including all areas, regardless of habitat designation, within 2 to 4 km of a lek NSO for lower activity sites (e.g., producing well pads) and all areas within 6 to 6.4 km of a lek NSO for higher activity sites (e.g., drilling rigs). Additionally consider restricting fluid mineral development in all areas, regardless of habitat designation, within 2 km of winter range and within 1 km of nesting habitats.** These suggestions are in addition to the NSO stipulation forwarded in the preferred alternative. Alternative B does not provide language analogous to these suggestions. **Enforce CSU stipulations within 4 miles of a lek** as stipulated under Alternative B if the goal of the preferred alternative for RAs and GHAs is to maintain the breeding habitats and populations associated with leks in GSA. **For RAs and GHAs, Alternative B is supported**

<u>Fluid Minerals—Development</u>

Summary of DEIS for Fluid Minerals—Development

The preferred alternative establishes that surface-disturbing activities, including rights-of-way (ROWs), would be avoided in PPA and in RA, and would be avoided within 2 miles of leks in GHA. In contrast, Alternative B establishes that: surface-disturbing activities would not be allowed in PPA; surface-disturbing activities would not be allowed within 4 miles of a lek except when activity maintains sage-grouse habitat functionality in GHA; surface-disturbing activities would not be allowed in sections within 1 mile of a lek containing ≤3 wells in RA; a 1% surface disturbance cap concurrent with a 5% surface disturbance cap per section in PPA and GHA would be implemented; and that habitat “compensation” would be required for surface disturbing activities in PPA, GHA and RA.

Distance effects of infrastructure on sage-grouse are described under Fluid Minerals—Leasing.

Analysis of Fluid Minerals—Development

The NSO established for RAs in Alternative B represents a technique of identifying areas near leks (at a maximum distance of 2 miles from a lek) with low densities of wells and maintaining those areas in a state of low well densities. Substantial amounts of research suggest that reducing infrastructure densities around leks will benefit sage-grouse. Harju et al. (2010) reported that common well pad densities of 4 and 8 pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below one pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding one well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (8 pads/section).

Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggests that these structures may negatively influence sage-grouse habitat selection and survival. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.20 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission line increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors as gas wells. See also discussion under rights-of-way below. Other often cited studies that may provide evidence of impacts of power lines on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data. Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within 2 years, but this study had a sample size of one lek. Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only 2 juvenile grouse were killed by running into power lines.

Recommendation for Fluid Minerals—Development

- **Develop approaches to limiting infrastructure densities, reducing infrastructure in areas near important seasonal habitats, and reducing human activity levels within important seasonal habitats for the preferred alternative.** Avoidance of activity in sage-grouse habitat is not sufficient to maintain sage-grouse populations. The technique of limiting infrastructure densities described in Alternative B may not include enough habitat (2 mile maximum distance from a lek), but may be too restrictive relative to densities (e.g., maintain areas where well densities are currently ≤1 pad per section).
- **Include avoidance of sage-grouse habitats for ROWs, as stipulated in the preferred alternative,** due to the inconclusive nature of current research**.**

<u>Best Management Practices (BMPs) Appendix (BMP-1)</u>

Summary of DEIS for BMPs

The following were included in the Appendix, among others, as BMPs: (1) timing stipulations for construction of power lines and renewable energy facilities, exploratory drilling, and development of solid minerals; (2) noise levels from production facilities restricted to 49 decibels (10 dBA above background) at leks (note that in the BMP appendix, 30-34 dBA was also used as a benchmark for 10 dBA above background); (3) only treatments that conserved, enhanced, or restored sage-grouse habitat would be considered; (4) facilities associated with sub-surface mining and fluid mineral development need to be placed outside PPA boundaries or co-located with other disturbance within PPA boundaries; (5) 3% direct surface disturbance and one site/section threshold suggested but, when this threshold is surpassed, "effective mitigation will be necessary to offset resulting loss of sage-grouse habitat and impacts to populations" in PPA; and (6) unitization is encouraged in PPA, and co-location of infrastructure was mentioned for PPA and GHA. Each of these BMPs is discussed in further detail below:

Analysis of Timing Restriction BMPs (#1)

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse during the winter avoiding the infrastructure of a gas field during the day, but not at night. This suggests that avoidance was of human activity rather than the infrastructure itself. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period. Traffic levels were not measured but increased levels were inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig. These studies would suggest timing restrictions may be effective if human activity around infrastructure in or near seasonal ranges is eliminated or minimized.

It is worth noting that BMPs are not stipulations; they are suggestions to be followed when deciding management activities for COAs.

Recommendation for Timing Limitations

- **Minimize human activity at infrastructure placed within seasonally protected areas**. Recommendations forwarded in the literature as well as the NTT report suggest seasonal timing restrictions are ineffective, especially relevant in general as timing restrictions do not apply to operation and maintenance of production facilities.

Analysis of Noise Restriction BMPs (#2)

Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73%, and leks treated with noise from natural gas drilling rigs decreased 29%, relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig.

Recommendation for Noise Restriction BMPs

- **Generally limit ambient noise levels to 20 to 24 dBA. However, ambient noise levels should be established at least on a region-by-region basis** (see Patricelli et al. 2013).

Analysis of Habitat Treatments (#3)

Although the premise of the stipulation forwarded in the preferred alternative that only treatments that conserve, enhance or restore sage-grouse habitat be allowed is on the surface sound, it is extremely important to note that the enhancement or restoration of sagebrush habitats is not a trivial task. There is tremendous uncertainty as to the vegetative and sage-grouse population outcomes of habitat manipulations (Johnson and Holloran 2010). Managers often justify habitat manipulations with potential long-term benefits, but the long-term effects of the available habitat manipulation options to habitats and consequences to sage-grouse of most are unknown. Extreme caution and discretion should be employed when proposing a habitat treatment, especially on drier sites, sites where cheatgrass may invade, and sites with limited potential to produce sagebrush (e.g., the interface between the Wyoming Basin and the Great Plains; Cagney et al. 2010). Although mitigation plans should be developed at landscape spatial scales, development at this scale does not necessitate that treatments be implemented across these scales. A small-scale, case-by-case treatment regime conducted over the long term should be implemented. Connelly et al. (2000)—in the sage-grouse habitat management guidelines—recommend that no more than 20% of the nesting, early brood-rearing and wintering habitats (in combination) in a landscape be in a treated state at any one time; recovery from treatment should be considered ≥12% canopy cover in Wyoming big sagebrush and ≥15% in mountain big sagebrush-dominated areas.

Recommendation for Habitat Treatments

- **Include language regarding the uncertainty of sagebrush enhancement or treatment.**
- **Adopt a region-wide habitat management plan that addresses site-specific actions in the context of the landscape as an appendix to the DEIS**. The plan needs to be generated from an analysis of all available information, include projections of the vegetative and sage-grouse population response to potential management actions, outline specific pre and post-treatment monitoring requirements, and should set in motion a process whereby data from implemented actions are used to inform future actions in an iterative cycle where mitigation actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The adaptive context established by a mitigation plan iteratively evaluated is extremely important given the uncertainty surrounding sagebrush habitat management. Note that this recommendation is pertinent to #5 in this list as well.

Analysis of Infrastructure Placement (#4)

Concerns associated with this BMP are discussed at length in the fluid minerals sections.

Analysis of Surface Disturbance Cap (#5)

Substantial amounts of research suggesting that reducing infrastructure densities around leks will benefit sage-grouse is available and discussed at length above. However no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the "developed" covariate examined included urban and suburban areas, and interstate and state highways as classified by Landfire (2006) and was quantified within 1-km grid cells. Therefore the results may not be comparable how the stipulations in the DEIS are forwarded.

Recommendation for Surface Disturbance Cap

- **Minimize energy development infrastructure densities to one per section averaged across an area designated by a 3- to 3.2-km radius, as research supports.** A consistently applied surface disturbance threshold is not supported in the literature, though see #6 below.

Analysis of Unitization (#6)

Unitization may benefit sage-grouse by resulting in the co-location or clustering of infrastructure of energy development. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al. (2007) found that gas development—measured as the proportion of area around a lek within 350 m of the infrastructure of a gas field—within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities.

Recommendation for Unitization

- **Reconcile the potential contradiction between a per-section surface disturbance threshold and unitization that clusters infrastructure in smaller areas**. The potential benefits of unitization (i.e., the co-location or clustering infrastructure of energy developments) may be non-compatible with the per section surface disturbance thresholds as forwarded as a BMP (see #5 above) where permitted disturbances are limited to one site/section. Limiting disturbance to one well pad/infrastructure per section, unless quantified as an average across a larger landscape, will counteract and contradicts the goal of clustering infrastructure assumed under unitization.

Rights-of-Way (ROW)

Summary of DEIS for ROWs

In addition to ROW guidance summarized above, making sage-grouse habitats avoidance areas for ROWs, power lines would be allowed in sage-grouse habitats with "specialized design features." Additionally, perch deterrents were included in the BMP appendix.

Analysis of ROWs (for Perch Deterrents)

Research relevant the impact of power lines on sage-grouse is discussed at length above.

Slater and Smith (2008) reported that perch deterrents reduced the occurrence of corvids and raptors relative to a control (non-deterred) line, but that perching was not entirely prevented. Lammers and Collopy (2007) found that perch deterrents reduced the probability of a raptor or corvid perching on a power pole and reduced the duration of perching, but they also reported that perching was not entirely prevented by perch deterrents. In contrast, Prather and Messmer (2010) found that perch deterrents were ineffective at reducing the number of perch-events of raptors and corvids.

Recommendation for ROWs (Perch Deterrents)

- **Consider the option of changing PPA and RA from avoidance to exclusion areas.** Because of the inconclusive nature of current research, **the stipulations for core areas outlined in the preferred alternative may be sufficient.** However, as research results become available, there may be increased support for establishing all sage-grouse habitat as exclusion areas for ROWs.
- **Avoid substitute anti-perching devices for burial or elimination of power lines to maintain habitat** because perch-deterrents reduce but do not eliminate perching on power poles by raptors and corvids. Anti-perching devices should only be considered where burial is not an option.

Fire

Summary of DEIS for Fire

The preferred alternative allows for a variety of treatment methods—including prescribed fire—to be used for treating sagebrush communities and sage-grouse habitats. Alternative B does not allow prescribed fire in sage-grouse habitats.

Analysis of Fire

The Sage and Columbian Sharp-tailed Grouse Technical Committee (2009) suggest that the scientific evidence supporting the use of prescribed fire for sage-grouse conservation is scant while considerable information documenting negative effects of fire on sage-grouse exists. The authors recommend avoiding the use of prescribed fire in xeric sagebrush habitats. Fischer et al. (1996) reported that the abundance and biomass of ants was reduced the second and third years after treatment; Nelle et al. (2000) reported a significant increase in ant and beetle abundance one year post-treatment, but abundance levels had returned to untreated level within 3 to 5 years. Slater (2003) reported no difference in abundance or biomass between treated and untreated sites. These results suggest treatments may have limited utility as a tool for sage-grouse brood-rearing habitat management. Slater (2003) also reported no difference in nest success probabilities within and outside burn boundaries (35 vs. 20% respectively). Overall nest success in his study (24%) was very low, suggesting potential impacts to nest success at spatial scales larger than actual treatments. Nelle et al. (2000) reported that prescribed fire negatively affected habitat conditions for sage-grouse nesting and brood rearing up to 15 years post-burn. Beck et al. (2009), after investigating the impact to wintering, nesting, and early brood habitat 14 years post-burn, concluded managers should not consider prescribed fire in xeric sagebrush habitats.

Recommendation for Fire

- **Do not include prescribed fire as a tool for treatments meant to improve habitat conditions for sage-grouse in areas where fire is not being used to specifically target range issues (e.g., cheatgrass)**, as supported by Alternative B.

<u>Disease</u>

Summary and Analysis for Disease

The DEIS establishes that water developments, “where deemed effective,” would be managed to reduce the spread of West Nile virus.

Presently, sage-grouse lack resistance to West Nile virus (WNv) and exposure to the virus results in 100% mortality (Clark et al. 2006). Given relationships between temperature, water and WNv, climate change, if resulting in higher temperatures and drier summer conditions in the western U.S. as most models predict, may increase impacts of WNv on sage-grouse populations.

Recommendation for Disease

- **Require that all water developments, including those developed for livestock, are built and/or maintained to reduce larval habitats for Cx. tarsalis mosquitoes.**

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Vegetation Management

Summary of DEIS for Vegetation Management

The preferred alternative stipulates that, prior to initiating vegetation treatments in Preliminary Priority Management Areas (PPMAs) and Preliminary General Management Areas (PGMAs), the area slated for treatment will be rested from livestock grazing for one growing season to increase resiliency of vegetation communities prior to treatment. Where winter range has been identified as a limiting factor, the preferred alternative establishes that vegetation treatments be emphasized in known winter range. This differs from Alternative B—the alternative in the DEIS aligned with the recommendations forwarded in the NTT report—in that Alternative B would not allow fuel treatments in known winter range. The preferred alternative establishes that in PPMAs and PGMAs where riparian extent is limited by shrub encroachment, fuels treatments including prescribed fire should be considered to expand mesic areas.

In NV and CA, PPMA and PGMA designations were developed from a foundation in habitat type and condition modified and verified with sage-grouse data and expert opinion. Essentially all habitats supporting a sagebrush overstory were designated as either PPMA or PGMA, with habitats considered essential/irreplaceable or important designated as PPMAs and habitats of moderate importance designated as PGMAs.

Analysis of Vegetation Management

Resiliency in the context of the ecological site concept is used to describe a vegetative state that is relatively stable to disturbance. Pyke (2011) uses the following to describe a state: “a relatively stable set of plant communities that are resilient to disturbances.” Pyke also indicates that changes in proportional cover of different vegetative growth forms in sagebrush systems following removal of livestock may take 10-15 years. Thus, removal of livestock for one growing season may not be sufficient to establish resilience on a site. Given good growing conditions, one year of rest from livestock has the potential to provide for the individual herbaceous plants on the site expressing themselves to potential (Cagney et al. 2010), suggesting that the individual plants on an already resilient site may benefit from one year of rest. But, in these situations, Miller and Eddleman (2001) concluded that no evidence exists to suggest treatment will enhance sage-grouse habitat in Wyoming big sagebrush-dominated communities where there already exists a balance of native shrubs, perennial grasses and forbs.

Although the preferred alternative indicates that objectives of treatments in winter range should be to enhance habitat quality or reduce wildfire risk, research does not support the use of treatments that reduce the shrub overstory in winter habitats. Swenson et al. (1987) reported that the conversion of 30% of the wintering sagebrush-dominated habitats in a 202-km^2 area by plowing resulted in a 73% decline in the number of breeding male sage-grouse on leks in the area relative to controls. Connelly et al. (1994) reported that the removal of approximately 60% of the sagebrush cover in a 5000-ha area resulted in a significant decline in the use of these sites during the winter (34 and 42% of locations pre- versus 6% post-burn). The Sage and Columbian Sharp-tailed Grouse Technical Committee (2009) suggest that the scientific evidence supporting the use of prescribed fire for sage-grouse conservation is scant while considerable information documenting negative effects of fire on sage-grouse exists. The authors recommend avoiding the use of prescribed fire in xeric sagebrush habitats.

The amount of habitat suitable for late brood-rearing surrounding a riparian area is generally dictated by the extent of the hyporheic zone—or the region beneath and alongside a water body where there is mixing of groundwater and surface water—which is influenced by pressure gradient differences within the channel (Committee on Riparian Zone Functioning et al. 2002). Prescribed fire in riparian habitats, unless done at a scale large enough to influence the amount of water reaching a stream channel and thereby influence pressure gradients within the stream, will not necessarily result in expanded mesic zones important for late brood-rearing surrounding a water source. Additionally, Braun et al. (1977) suggest that sagebrush along streams, drainages, and meadows be protected as these areas provide important summer habitat.

Recommendation for Vegetation Management

- **Do not include prescribed fire as a tool for treatments meant to improve habitat conditions for sage-grouse in areas where fire is not being used to specifically target range issues (e.g., cheatgrass)**, as supported by Alternative B and the NTT report.
- **Consider a passive approach to management as described by Pyke (2011) in situations where rest from livestock may result in increased resilience of a site towards vegetative conditions desirable for sage-grouse**. This is recommended because research suggests that one year of rest will not influence vegetative resilience of a site. **,**
- **Require the site be afforded the period of rest required for the desirable individual plants to become resilient to the proscribed treatment in situations where the objective of treatment is changing vegetative states, but desirable plant species are present on the site (just not in desirable densities).** For example, if a cool-season bunchgrass-dominated understory is desired on a site, and some plants of these species are present on the site, ensure that root reserves of these individuals are sufficient to withstand treatment (Cagney et al. 2010).

Do not require pre-treatment rest from livestock in situations where no desirable understory species are present on a site. Focus on management actions that may influence the extent of the hyporheic zone (e.g., livestock grazing; see Dobkin et al. 1998) rather than on prescribed fire as a tool for expanding suitable late-brood habitats in riparian zones.

<u>**Invasive species and conifer encroachment**</u>

Summary of DEIS for Invasive Species and Conifer Encroachment

The preferred alternative stipulates that targeted early season grazing for suppressing cheatgrass and other invasive species would be allowed as long as livestock is removed when utilization of desirable species reaches 35%.

Analysis of Invasive Species and Conifer Encroachment
Utilization levels of desirable species stipulated in the preferred alternative should result in low to moderate utilization of all herbaceous vegetation. According to Cagney et al. (2010), no more than moderate utilization is a key factor in the long-term maintenance and development of a desirable plant community. However, utilization objectives must be applied to locations within an allotment or pasture preferred by livestock (e.g., areas with gentle terrain near water sources); evaluating use levels as an allotment average will assure that preferred areas within the allotment are over-utilized (Cagney et al. 2010).

Recommendation for Invasive Species and Conifer Encroachment

- **Indicate specifically that 35% utilization levels of desirable species should be evaluated in areas within the allotment or pasture preferred by livestock in the preferred alternative.**

<u>**Climate Change**</u>
Summary of DEIS for Climate Change
The preferred alternative stipulates that various treatments (e.g., seeding and shrub planting) be implemented to restore sage-grouse habitat.

Analysis of Climate Change
Climate change may result in given locations becoming unsuitable for sagebrush resulting in shifts in the species' distribution (Bradley 2010); as such, treatments implemented to restore sagebrush into areas where the species is disappearing due to abiotic conditions becoming unsuitable will be ineffective. Schlaepfer et al. (2012) suggest that most climate change scenarios forecast sagebrush distributions increasing at higher elevations (e.g., at the interface with coniferous forest).

Recommendation for Climate Change

- **Require an assessment of abiotic conditions**, including the identification of mechanisms resulting in changing abiotic conditions.
- **Do not attempt to restore sites where climate change has resulted in a site becoming unsuitable for the growth or recruitment of sagebrush** unless the changes in abiotic conditions resulting in the loss of sagebrush can be reasonably addressed.

<u>**Fluid Minerals**</u>
Summary of DEIS for Fluid Minerals
The preferred alternative allows for fluid mineral leasing in PPMA, but with a NSO stipulation with no waivers, exceptions or modifications. A NSO would also be applied to PGMA but waivers, exceptions or modifications to this stipulation would be allowed. The preferred alternative also establishes seasonal timing restrictions for geophysical exploration in PPMA and PGMA habitats. The preferred alternative differs from Alternative B in that Alternative B closes PPMA to fluid mineral leasing. Both alternatives allow for infrastructure required to develop unleased fluid mineral resources to be placed outside the boundaries of PPMA, and both stipulate seasonal time restrictions for geophysical exploration.

Analysis of Fluid Minerals
The potential indirect effects of infrastructure on sage-grouse were not addressed by either the preferred alternative or Alternative B. This may be important in situations where infrastructure is placed outside of PPMAs but within close proximity to the PPMA boundary. Several authors have reported a "distance-effect" associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts to lekking sage-grouse of well pads located at shorter distances to leks were more consistently observed across energy fields compared to well pads at longer distances, with a consistent pattern whereby the presence of well pads within smaller radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development to the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species.

Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

Timing restrictions are discussed at length below under *Leased Federal Fluid Mineral Estate*.

Recommendation for Fluid Minerals

- **Adopt the NSO stipulation in the preferred alternative, as it is generally sufficient for protecting PPMA.** However, the preferred alternative does not directly address a distance effect of infrastructure through the siting of infrastructure. **Consider including all areas, regardless of habitat designation, within 2 to 4 km of a lek NSO for lower activity sites (e.g., producing well pads) and all areas within 6 to 6.4 km of a lek NSO for higher activity sites (e.g., drilling rigs). Additionally consider restricting fluid mineral development in all areas, regardless of habitat designation, within 2 km of winter range and within 1 km of nesting habitats.** These suggestions are in addition to the NSO stipulation forwarded in the preferred alternative. Alternative B does not provide language analogous to these suggestions.

Leased Federal Fluid Mineral Estate

Summary of Leased Federal Fluid Mineral Estate

The preferred alternative stipulates that proposed surface disturbance on leased fluid mineral estates must achieve a no net unmitigated loss of PPMAs. Conversely, Alternative B establishes that surface disturbance for leases within PPMAs will not exceed 3% of the lease, and that surface disturbance will not exceed one per section (square mile) and 3% per section. Alternative B would require unitization when deemed necessary. Unitization provides for the exploration, development, and operation of a geologically defined area by a single operator making phased and/or clustered development more tenable. Both alternatives stipulate seasonal timing restrictions for exploratory drilling that prohibit surface-disturbing activities during nesting and early brood-rearing seasons in PPMAs, with the preferred alternative adding timing restrictions to winter and lekking seasons.

Analysis of Leased Federal Fluid Mineral Estate

Although the premise of the stipulation forwarded in the preferred alternative that all surface disturbance in PPMAs will be mitigated is on the surface sound, it is extremely important to note that the enhancement or restoration of sagebrush-habitats is not a trivial task. There is tremendous uncertainty as to the vegetative and sage-grouse population outcomes of habitat manipulations (Johnson and Holloran 2010). Managers often justify habitat manipulations with potential long-term benefits, but the long-term effects of most of the available habitat manipulation options to habitats and consequences to sage-grouse are unknown. Extreme caution and discretion should be employed when proposing a habitat treatment, especially on drier sites, sites where cheatgrass may invade, and sites with limited potential to produce sagebrush (e.g., the interface between the Wyoming Basin and the Great Plains; Cagney et al. 2010). Although mitigation plans should be developed at landscape spatial scales, development at this scale does not necessitate that treatments be implemented across these scales. A small-scale, case-by-case treatment regime conducted over the long term should be implemented. Connelly et al. (2000)—in the sage-grouse habitat management guidelines—recommend that no more than 20% of the nesting, early brood-rearing and wintering habitats (in combination) in a landscape be in a treated state at any one time; recovery from treatment should be considered ≥12% canopy cover in Wyoming big sagebrush and ≥15% in mountain big sagebrush-dominated areas.

Substantial amounts of research suggest that reducing infrastructure densities around leks will benefit sage-grouse. However, no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Harju et al. (2010) reported that common well pad densities of 4 and 8 pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below one pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding one well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (8 pads/section).

Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the "developed" covariate examined included urban and suburban areas, and interstate and state highways as classified by Landfire (2006) and was quantified within 1-km grid cells. Therefore, the results may not be comparable to how the stipulations in Alternative B are forwarded.

Unitization may benefit sage-grouse by resulting in the co-location or clustering of infrastructure of energy development. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al. (2007) found that gas development—measured as the proportion of area around a lek within 350 m of the infrastructure of a gas field—within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities.

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse during the winter avoiding the infrastructure of a gas field during the day, but not at night suggesting that avoidance was of human activity rather than the infrastructure itself—this would suggest timing restrictions may be effective at least during the winter if human activity to infrastructure in or near winter ranges is eliminated or minimized.

Recommendation for Leased Federal Fluid Mineral Estate

- **Implement the stipulations in Alternative B for leasing on the federal mineral estate, which are generally supported by scientific literature.** There is significant uncertainty surrounding actions that effectively and consistently enhance sagebrush habitats as part of mitigation measures. At minimum, language should be added to the preferred alternative establishing the uncertainty surrounding enhancement of sagebrush habitats with treatment.

- **Expand Appendix D (Mitigation Strategy) into a more detailed region-wide habitat management plan that addresses site-specific actions in the context of the landscape**. The plan needs to be generated from an analysis of all available information, include projections of the vegetative and sage-grouse population response to potential management actions, outline specific pre and post-treatment monitoring requirements, and should set in motion a process whereby data from implemented actions are used to inform future actions in an iterative cycle where mitigation actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The adaptive context established by a mitigation plan iteratively evaluated is extremely important given the uncertainty surrounding sagebrush habitat management.
- **Limit energy development infrastructure densities to one per section averaged across an area designated by a 3- to 3.2-km radius**. A consistently applied surface disturbance threshold is not supported in the literature. If a surface disturbance threshold is to be applied, it is recommended that **the surface disturbance threshold be established as the proportion of area disturbed by a metric that can be directly related to infrastructure density**. For example, an average sized well pad, plus its access road, may define a given number of acres that can be divided by 640 to establish a surface disturbance threshold that is directly relevant the density threshold of one well pad/section reported in the literature.
- **Include a technique to limiting infrastructure densities that allows for and encourages the clustering or co-locating of infrastructure on the landscape.** It is worth noting that the 3% anthropogenic surface disturbance threshold, if calculated at the scale of a square mile as established in the preferred alternative as well as Alternative B, will not alleviate the need to address co-location.
- **Minimize human activity at infrastructure placed within seasonally protected areas.** Although seasonal timing restrictions are stipulated in the preferred alternative, recommendations forwarded in the literature as well as the NTT report suggest seasonal timing restrictions are ineffective. For example, Appendix A (Required Design Features) lists the following as RDFs for fluid mineral development in priority habitats: "establish trip restrictions or minimization through use of telemetry and remote well control", "place liquid gathering facilities outside of priority areas" and "use remote monitoring techniques for production facilities and develop a plan to reduce the frequency of vehicle use"; requiring these practices when developing fluid minerals in sage-grouse habitats could reduce human activity levels in these areas.

<u>Salable minerals</u>

Similarly to leased fluid minerals, the preferred alternative stipulates that proposed surface disturbance on existing mineral materials leases must achieve a no net unmitigated loss of PPMAs.

The literature review and recommendations regarding sagebrush habitat management and mitigation for leased fluid minerals apply here as well.

<u>Lands and Realty—Land Use Authorizations</u>

Summary of DEIS for Lands and Realty—Land Use Authorizations

The preferred alternative makes PPMAs right-of-way (ROW) avoidance areas. The preferred alternative differs from Alternative B in that Alternative B makes PPMAs exclusion areas for new ROW permits. The preferred alternative additionally stipulates that ROW holders retro-fit existing structures in PPMAs and PGMAs with perch-deterring devices during ROW renewal processes. Also, transmission towers would be included in this stipulation per a Required Design Feature (RDF) listed in Appendix A. Avoidance areas are described as areas where ROW development would be allowed to occur if the development incorporates appropriate RDFs in design and construction (e.g., noise, tall structure, seasonal restrictions, etc.), is sited and developed in non-habitat or bundled with existing corridors, and development results in no net unmitigated loss of priority or general habitat. Exclusion areas are those where new ROWs are allowed only if the entire footprint of the proposed project (including construction and staging) can be completed within the existing disturbance associated with existing ROWs. It is worth noting a potential contradiction in RDFs listed for the preferred alternative: new ROWs must be placed at least 2 miles from leks, but new power lines must be placed at least 3 miles from breeding, nesting, brood-rearing and winter habitats.

Analysis of Lands and Realty—Land Use Authorizations

Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggestive that these structures may negatively influence sage-grouse habitat selection and survival. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.20 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission line increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer transmission to lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors as gas wells. See also discussion under rights-of-way below. Other often cited studies that may provide evidence of impacts of power lines on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data. Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within 2 years, but this study had a sample size of one lek. Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only 2 juvenile grouse were killed by running into power lines.

Slater and Smith (2008) reported that perch deterrents reduced the occurrence of corvids and raptors relative to a control (non-deterred) line, but that perching was not entirely prevented. Lammers and Collopy (2007) found that perch deterrents reduced the probability of a raptor or corvid perching on a power pole and reduced the duration of perching, but they also reported that perching was not entirely prevented by perch deterrents. In contrast, Prather and Messmer (2010) found that perch deterrents were ineffective at reducing the number of perch-events of raptors and corvids.

Recommendation for Lands and Realty—Land Use Authorizations

- **Maintain the option of changing sage-grouse habitats from avoidance to exclusion areas in the DEIS.** Because of the inconclusive nature of current research**, the stipulations outlined in the preferred alternative may be sufficient.** However, as research results become available, there may be increased support for establishing all sage-grouse habitat as exclusion areas for ROWs as stipulated under Alternative B.
- **Avoid substituting anti-perching devices for burial or elimination of power lines to maintain habitat** because perch-deterrents reduce but do not eliminate perching on power poles by raptors and corvids.

North Dakota Greater Sage-Grouse Draft RMP/EIS

Fluid Minerals—Unleased

Summary of DEIS for Fluid Minerals—Unleased

The preferred alternative allows for fluid mineral leasing in PPH, but with a NSO stipulation. Essentially, under the preferred alternative, fluid minerals can be leased in PPH but must be accessed from infrastructure placed outside of PPH boundaries. In PGH, surface occupancy would be subject to CSU constraints. These differ from Alternative B—the alternative in the DEIS most closely aligned with the recommendations forwarded in the NTT report—in that Alternative B closes PPH to fluid mineral leasing. PPH within the planning area was delineated by buffering leks by 5.3 miles; PGH includes all known habitat not encompassed by PPH.

Recommendation for Fluid Minerals—Unleased

- **Adopt the he NSO stipulation for PPH in the preferred alternative, as it is supported by the scientific literature**. Given the process for delineating PPH in North Dakota (e.g., a 5.3-mile buffer around leks), indirect effects of energy development to sage-grouse on leks should in general be minimized.

Fluid Minerals—Leased

Summary of DEIS for Fluid Minerals—Leased

The preferred alternative does not establish specific COA for development of existing leases other than establishing that surface disturbing activities should minimize disturbance to sage-grouse. The preferred alternative establishes that anthropogenic noise exceeding 49 dBH at ¼ mile from a lek would not be allowed, and remote monitoring of production facilities would be required. The preferred alternative allows for exceptions to COAs if impacts are mitigated to an acceptable level. In contrast, Alternative B does not allow surface occupancy in PPH unless the entire lease is within PPH; in these instances a 4-mile NSO and a surface disturbance cap of not more than one disturbance per section with no more than 3% surface disturbance in that section are established.

Analysis of Fluid Minerals—Unleased

Several authors have reported a “distance-effect” associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts to lekking sage-grouse of well pads located at shorter distances to leks were more consistently observed across energy fields compared to well pads at longer distances, with a consistent pattern whereby the presence of well pads within smaller radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development to the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species. Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

Substantial amounts of research suggest that reducing infrastructure densities around leks will benefit sage-grouse. However, no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Harju et al. (2010) reported that common well pad densities of 4 and 8 pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below one pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding one well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (8 pads/section).

It is worth noting that the potential benefits of co-location or clustering infrastructure (a potential benefit of unitization as stipulated in Alternative B) of energy developments may be non-compatible with the per section surface disturbance thresholds as forwarded in Alternative B where permitted disturbances are limited to one per section with no more than 3% surface disturbance in that section. Limiting disturbance to one well pad/infrastructure and 3% surface disturbance per section as established in Alternative B, unless quantified as an average across a larger landscape, will counteract and contradicts the requirement of clustering infrastructure. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al. (2007) found that gas development—measured as the proportion of area around a lek within 350 m of the infrastructure of a gas field—within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities.

Ambient noise levels of 20 to 24 dBA reflect those measured in sagebrush systems in Wyoming; given these ambient noise levels, the stipulation of limiting noise levels to 49 dBH would allow for noise up to twice as high as ambient within ¼ mile of a lek. Patricelli et al. (2013) recommend that ambient noise levels should be established at least on a region-by-region basis and anthropogenic noise should not exceed 10 dBA above ambient at the perimeter of a lek.

Although the premise of the stipulation forwarded in the preferred alternative that COAs can be waived given effective mitigation is on the surface sound, it is extremely important to note that the enhancement or restoration of sagebrush-habitats is not a trivial task. There is tremendous uncertainty as to the vegetative and sage-grouse population outcomes of habitat manipulations (Johnson and Holloran 2010). Managers often justify habitat manipulations with potential long-term benefits, but the long-term effects to habitats and consequences to sage-grouse of most of the available habitat manipulation options are unknown. Extreme caution and discretion should be employed when proposing a habitat treatment, especially on drier sites, sites where cheatgrass may invade, and sites with limited potential to produce sagebrush (e.g., the interface between the Wyoming Basin and the Great Plains; Cagney et al. 2010). Although mitigation plans should be developed at landscape spatial scales, development at this scale does not necessitate that treatments be implemented across these scales; a small-scale, case-by-case treatment regime conducted over the long term should be implemented.

Recommendation for Fluid Minerals—Leased

- **Implement stipulations in Alternative B, as they are generally supported by the scientific literature for management of fluid minerals in leased areas**. Given the process for delineating PPH (e.g., a 5.3-mile buffer around leks), indirect effects of energy development to sage-grouse on leks should in general be minimized by the NSO stipulation forwarded in Alternative B. **Consider including all areas, regardless of habitat designation, within 2 to 4 km of a lek NSO for lower activity sites (e.g., producing well pads) and all areas within 6 to 6.4 km of a lek NSO for higher activity sites (e.g., drilling rigs).**
- **Restrict (e.g. NSO) fluid mineral development in all areas, regardless of habitat designation, within 2 km of winter range and within 1 km of nesting habitats.** It is worth noting that, although Alternative B in this instance is more supported by literature, the NSO distances established under this alternative are not supported by literature except for high activity sites near leks.
- **Employ a technique for limiting infrastructure densities and encourages the clustering or co-locating of infrastructure on the landscape.** Alternative B provides stipulations to development that consider distance and density effects of infrastructure. However, it is worth noting that the 3% anthropogenic surface disturbance threshold, if calculated at the scale of a square mile as established in Alternative B, will not alleviate the need to address co-location. Research supports the minimization of energy development infrastructure densities to one per section averaged across an area designated by a 3- to

3.2-km radius. Research suggests that the co-location or clustering of infrastructure reduces impacts of energy development to sage-grouse by reducing the proportion of a landscape indirectly influenced by that infrastructure. Thus, infrastructure density thresholds should be calculated across a larger area than 1 square mile to allow for clustering of infrastructure while maintaining an average of one pad/section.

- **Establish regional ambient noise levels and require that noise levels not exceed 10 dBA above ambient at the perimeter of leks.**
- **Add language to the preferred alternative establishing the uncertainty surrounding enhancement of sagebrush habitats with treatment i**f exceptions to COAs are to be awarded under the preferred alternative given acceptable levels of mitigation. **Additionally, consider adding a region-wide habitat management plan that addresses site-specific actions in the context of the landscape as an appendix** to the DEIS. The plan needs to be generated from an analysis of all available information, include projections of the vegetative and sage-grouse population response to potential management actions, outline specific pre and post-treatment monitoring requirements, and should set in motion a process whereby data from implemented actions are used to inform future actions in an iterative cycle where mitigation actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The adaptive context established by a mitigation plan iteratively evaluated is extremely important given the uncertainty surrounding sagebrush habitat management.

Coal

The preferred alternative allows for the placement of appurtenant facilities for subsurface coal mining in PPH within existing disturbed areas. Alternative B does not allow for the placement of these facilities in PPH.

The distance-effect literature reviewed above is applicable the preferred alternative here.

Recommendation for Coal

- **Include a NSO buffer distance of 2 to 4 km for lower activity sites (e.g., producing well pads) and 6 to 6.4 km for higher activity sites (e.g., drilling rigs) around leks, an NSO buffer distance of 2 km around winter range, and an NSO buffer of 1 km around nesting habitats, which current research supports**. **Alternative B is generally supported by the scientific literature.** Alternative B, which essentially establishes a 5.3-mile NSO, follows the literature more closely than the preferred alternative.

Locatable Minerals

The preferred alternative establishes that locatable mineral development would be examined on a case-by-case basis. This does not provide the information necessary to evaluate the effectiveness of this alternative.

The literature review under the Fluid Minerals sections is relevant here.

<u>Lands and Realty: Rights-of-Way (ROWs)</u>

Summary of DEIS for Lands and Realty: Rights-of-Way (ROWs)

The preferred alternative manages PPH as avoidance areas for ROWs. ROWs would be allowed in PGH. Conversely, in Alternative B, PPH is managed as exclusion areas for ROWs and PGH are avoidance areas for ROWs.

Analysis of Lands and Realty: Rights-of-Way (ROWs)ROWs

Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggests that these structures may negatively influence sage-grouse habitat selection and survival. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.20 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission line increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors as gas wells. See also discussion under rights-of-way below. Other often cited studies that may provide evidence of impacts of power lines on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data. Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within 2 years, but this study had a sample size of one lek. Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only 2 juvenile grouse were killed by running into power lines.

Recommendation for Lands and Realty: Rights-of-Way (ROWs)

- **Stipulate that PGH be avoidance areas for ROW development**, as established in Alternative B and evidence generally suggests. However, because of the inconclusive nature of current research, **the stipulations for PPH outlined in the preferred alternative may be sufficient.**

Oregon Greater Sage-Grouse Draft RMP/EIS

Fluid Minerals—Unleased

Summary of DEIS for Fluid Minerals—Unleased

The preferred alternative allows for fluid mineral leasing in Preliminary Priority Management Areas (PPMAs), but with a NSO stipulation on PPMA within 4 miles of leks, and an NSO on all areas within 1 mile of a lek located within PPMA. Essentially, under the preferred alternative, fluid minerals can be leased in these areas but must be accessed from infrastructure placed outside of these boundaries. PPMA beyond 4 miles of a lek located within PPMA are open to leasing subject to the following CSU stipulations: development cannot exceed 3% surface disturbance, seasonal timing restrictions during breeding, late brood-rearing and winter seasons, noise restrictions (noise at occupied leks does not exceed 10 dBH above ambient), and tall structure restrictions (man-made structures that have the potential to disrupt lekking or nesting sage-grouse as determined site-specifically). Areas outside of PPMA boundaries but within 4 miles of a lek located within PPMA would be subject to the noise and tall structure restrictions described above. Under the preferred alternative, Preliminary General Management Areas (PGMAs) are open to fluid mineral leasing with an NSO in areas within 1 mile of leks located within PGMA boundaries, and additionally subject to seasonal timing restrictions during breeding, late brood-rearing and winter seasons, noise restrictions, and tall structure restrictions. It is worth noting that stipulations within PGMA could be waived (except for seasonal timing restrictions) if off-site mitigation is successfully completed in PPMA. These differ from Alternative B—the alternative in the DEIS most closely aligned with the recommendations forwarded in the NTT report—in that Alternative B closes PPMA to fluid mineral leasing. PGMAs were not addressed in Alternative B. PPMA in Oregon was initially delineated by buffering leks by 4 miles and generating polygons of those merged buffers that included large proportions of males based on 2006 lek counts (see Doherty et al. 2011); these initial polygons were then clipped to occupied range and refined by removing areas within fire perimeters of areas that burned 2007-10.

Summary of Fluid Minerals—Leased

The preferred alternative lists the same stipulations as those listed for the unleased fluid mineral estate in PPMAs and PGMAs. Alternative B does not allow new surface occupancy in PPMAs unless the entire lease is within PPMA—in which case, a 4-mile NSO is applied, and surface disturbance is limited to one per section with no more than 3% surface disturbance in that section.

Analysis of Fluid Minerals

Several authors have reported a “distance-effect” associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts to lekking sage-grouse of well pads located at shorter distances to leks were more consistently observed across energy fields compared to well pads at longer distances, with a consistent pattern whereby the presence of well pads within smaller radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development to the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species. Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

Research directly relevant to the efficacy of 1-mile NSO buffer is not available. However, leks that had at least one well pad within 0.4 km (0.25 miles) had 35 to 92% fewer sage-grouse compared to leks with no well pads within this radii (Harju et al. 2010). Walker et al. (2007) reported that implementing a 0.4-km NSO given full field development within the remainder of a 0.8-km- or 3.2-km-radius area would result in lek persistence probabilities of 5% and 24%, respectively.

Substantial amounts of research suggesting that reducing infrastructure densities around leks will benefit sage-grouse are available. However, no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Harju et al. (2010) reported that common well pad densities of 4 and 8 pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below one pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding one well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (8 pads/section).

Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the "developed" covariate examined included urban and suburban areas, and interstate and state highways as classified by Landfire (2006) and was quantified within 1-km grid cells. Therefore, the results may not be comparable with how the stipulations in the DEIS are forwarded.

It is worth noting that the potential benefits of co-location or clustering infrastructure of energy developments as established as an RDF in the DEIS may be non-compatible with the per section surface disturbance thresholds as forwarded in Alternative B where permitted disturbances are limited to one per section with no more than 3% surface disturbance in that section. Limiting disturbance to one well pad/infrastructure and 3% surface disturbance per section as established in Alternative B, unless quantified as an average across a larger landscape, will counteract and contradicts the requirement of clustering infrastructure. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al. (2007) found that gas development—measured as the proportion of area around a lek within 350 m of the infrastructure of a gas field—within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities.

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse during the winter avoiding the infrastructure of a gas field during the day, but not at night, This suggests that avoidance was of human activity rather than the infrastructure itself. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period. Traffic levels were not measured but increased levels were inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig. These studies would suggest timing restrictions may be effective if human activity around infrastructure in or near seasonal ranges is eliminated or minimized.

Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggests that these structures may negatively influence sage-grouse habitat selection and survival—research relevant the tall structure restrictions applied under the preferred alternative. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.20 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission line increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors, as gas wells. Other often cited studies that may provide evidence of impacts of tall structures on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data. Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within 2 years, but this study had a sample size of one lek. Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only 2 juvenile grouse were killed by running into power lines.

The preferred alternative allows for the waiving of lease stipulations in PGMA given “successful” mitigation within PPMAs. Although this is a good idea for providing habitat improvement within PPMA, the enhancement or restoration of sagebrush-habitats is not a trivial task. There is tremendous uncertainty as to the vegetative and sage-grouse population outcomes of habitat manipulations (Johnson and Holloran 2010). Managers often justify habitat manipulations with potential long-term benefits, but the long-term effects to habitats and consequences to sage-grouse of most of the available habitat manipulation options are unknown. Extreme caution and discretion should be employed when proposing habitat treatments, especially on drier sites, sites where cheatgrass may invade, and sites with limited potential to produce sagebrush (e.g., the interface between the Wyoming Basin and the Great Plains; Cagney et al. 2010). Some treatments may be prudent to address habitat degradation because habitat degradation is a significant causal factor in sage-grouse declines (see Connelly et al. 2004). However, a conservative or limited approach to proactive habitat manipulations is warranted because we do not have all, or even many, of the answers when it comes to improving sagebrush habitat conditions for sage-grouse. Although mitigation plans should be developed at landscape spatial scales, development at these scales does not necessitate that treatments be implemented across these scales. A small-scale, case-by-case treatment regime conducted over the long term should be implemented. The plan needs to be generated rigorously from an analysis of all available information, and should set in motion a process whereby data from implemented actions are used to inform future actions in an iterative cycle where management actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The iterative evaluation is extremely important given the uncertainty surrounding sagebrush habitat management, and needs to be the central theme of implementation of any adaptive management plan.

Recommendation for Fluid Minerals

- **Institute the preferred alternative's NSO stipulation for PPMA, which is generally supported by the scientific literature.** However, modifications to PPMA boundaries may have resulted in areas not covered under the NSO being relatively close to leks and or other seasonal habitats, as evidenced by the 1-mile NSO around leks situated near PPMA boundaries stipulated in the preferred alternative.
- **Include all areas, regardless of habitat designation, within 2 to 4 km of a lek as NSO for lower activity sites (e.g., producing well pads) and all areas within 6 to 6.4 km of a lek NSO for higher activity sites (e.g., drilling rigs).**
- **Include restrictions for fluid mineral development in all areas, regardless of habitat designation, within 2 km of winter range and within 1 km of nesting habitats.** It is worth noting that the approach of addressing indirect distance effects presented in the preferred alternative of this DEIS—i.e., a 1-mile NSO regardless of habitat designation—is supported; however, the NSO distance established is not supported by literature except for buffers around nesting habitats.
- **Minimize human activity at infrastructure placed within seasonally protected areas.** Although seasonal timing restrictions are stipulated in the preferred alternative, recommendations forwarded in the literature as well as the NTT report suggest seasonal timing restrictions are ineffective. Minimization of human activity at infrastructure placed within seasonally protected areas may represent a management alternative to applying an NSO. For example, Appendix C (*Required Design Features*) lists the following as RDFs for fluid mineral development: "establish trip restrictions or minimization through use of telemetry and remote well control" and "place liquid gathering facilities outside of priority areas." Requiring these practices when developing fluid minerals in priority areas could reduce human activity levels in these areas.
- **Establish the surface disturbance threshold as the proportion of area disturbed by a metric that can be directly related to infrastructure density** if a surface disturbance threshold is to be applied in the preferred alternative. For example, one average sized well pad plus access road directly influences a given number of acres that can be divided by 640 to establish a surface disturbance threshold that is directly relevant the density threshold of one well pad/section reported in the literature. Research suggests that the co-location or clustering of infrastructure reduces impacts of energy development to sage grouse by reducing the proportion of a landscape indirectly influenced by that infrastructure. Thus, surface disturbance thresholds should be calculated across a larger area than 1 square mile to allow for clustering of infrastructure while maintaining the average one pad/section and surface disturbance threshold.
- Adopt the **tall structure restriction as stipulated in the preferred alternative** because of the inconclusive nature of current research**.**

- **Add language to the preferred alternative establishing the uncertainty surrounding enhancement of sagebrush habitats with treatment. Additionally, Appendix E (*Regional Mitigation Strategy*) should be further developed into a resource that would benefit energy developers considering development in PPMA or PGMA.** The mitigation strategy needs to be generated from an analysis of all available information, include projections of the vegetative and sage grouse population response to potential management actions, outline specific pre and post-treatment monitoring requirements, and should set in motion a process whereby data from implemented actions are used to inform future actions in an iterative cycle where mitigation actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The adaptive context established by a mitigation plan iteratively evaluated is extremely important given the uncertainty surrounding sagebrush habitat management.

<u>**Locatable Minerals**</u>
Summary of the DEIS for Locatable Minerals
The preferred alternative relies on existing sub-regional resource management plans for managing locatable minerals—the specifics of these plans were not provided. Alternative B recommends withdrawal from mineral entry locatable minerals.

The information required to assess the direct relationship between existing science and the preferred alternative were not provided. **In general, the literature reviewed and recommendations forwarded for fluid mineral development apply here.**

<u>**Non-energy Leasable Minerals**</u>
Summary of the DEIS for Non-energy Leasable Minerals
The development of non-energy leasable minerals is subject to an NSO in PPMA under the preferred alternative; only underground development options with entry outside of PPMA are considered. Alternative B closes PPMA to non-energy leasable mineral leasing.

The distance effect literature reviewed and recommendations forwarded for fluid mineral development apply here.

<u>**Required Design Features (RDFs) and Best Management Practices (BMPs)—Appendices C and D**</u>
Summary of the DEIS's appendices regarding RDFs and BMPs
Recommendations within the appendices include limiting activity levels and vehicle speeds on roads, clustering and minimizing amounts of infrastructure, anti-perching devices on above ground facilities to discourage nesting of raptors and corvids, and controlling the spread of West Nile virus (WNv) through the design of surface water disposal structures.

Analysis of RDFs and BMPs
Sage grouse avoidance of high-activity roads is well documented. Connelly et al. (2004) found that no leks occurred within 2 km of Interstate 80, there were fewer leks within 7.5 km than

within 15 km of the interstate, and there were higher rates of decline in lek counts between 1970 and 2003 on leks located within compared to beyond 7.5 km of the interstate. Knick et al. (2013) reported that high habitat suitability was associated with <1.0 km/km^2 of secondary roads, 0.05 km/km^2 of highways, and 0.01 km/km^2 of interstate highways within 5-km-radius areas. LeBeau (2012) found that sage grouse avoided nesting and summering near major roads (e.g., paved secondary highways). Tack (2009) found negative relationships with more roads around leks at all levels of lek attendance, but impacts were greatest for larger leks (>25 males); the probability of occurrence of a large lek was 50% with road densities of approximately 25 km of road within 3.2 km of a lek. Dzialak et al. (2012) documented sage-grouse during the winter avoiding haul roads associated with natural gas development. In contrast, results from some of the smaller road categories, Johnson et al. (2011) found negative trends with distance to interstate highway—although few leks occurred near interstates; relatively consistent slight negative trends with distance to highways; and no relationship between distance to secondary roads and lek trends. Road densities within a 5-km radius of leks suggested similar relationships by road category (Johnson et al. 2011).

Restrictions on the volume of vehicle traffic on roads in sage-grouse habitats as a means of reducing the impacts of roads to sage-grouse are supported management actions. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period. Traffic speed was not measured but the potential for increased speed was inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes and that vehicle activity on roads within 3 km of leks during the time of day sage-grouse were present on leks influenced the number of males on leks more negatively than leks where roads within 3 km had no vehicle activity during the strutting period. Lyon and Anderson (2003) reported that traffic disturbance (1 to 12 vehicles/day) within 3 km of leks during the breeding season reduced nest-initiation rates and increased distances moved from leks during nest site selection of female sage-grouse breeding on those leks. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig.

Slater and Smith (2008) reported that perch deterrents reduced the occurrence of corvids and raptors relative to a control (non-deterred) line, but that perching was not entirely prevented. Lammers and Collopy (2007) found that perch deterrents reduced the probability of a raptor or corvid perching on a power pole and reduced the duration of perching, but they also reported that perching was not entirely prevented by perch deterrents. In contrast, Prather and Messmer (2010) found that perch deterrents were ineffective at reducing the number of perch-events of raptors and corvids.

Presently, sage-grouse lack resistance to West Nile virus (WNv) and exposure to the virus results in 100% mortality (Clark et al. 2006). It is worth noting that given relationships between temperature, water and WNv, climate change if resulting in higher temperatures and drier summer conditions in the western U.S. as most models predict may increase impacts of WNv on sage-grouse populations.

Recommendation for RDFs and BMPs

- **Translate applicable management guidelines in the referenced appendixes to management stipulations within the RMP**
- **Consider seasonal closures of roads within sage-grouse habitats and establishing a prohibition of roads around leks.**
- **Avoid substituting anti-perching devices for burial or elimination of power lines to maintain sage-grouse habitats** because perch-deterrents reduce but do not eliminate perching on power poles by raptors and corvids.

<u>**Vegetation Management**</u>

Summary of DEIS for Vegetation Management

The preferred alternative establishes that "species composition, function, and structure of sagebrush communities should be consistent with ecological site capabilities." The preferred alternative does not expressly restrict the use of fire in sagebrush habitats. Alternative B includes habitat parameters important for sage-grouse when managing vegetation, and does not allow the use of fire in xeric (<12-inch precipitation zones) sagebrush communities.

Analysis of Vegetation Management

Management of sagebrush habitats for sage-grouse in the context of state-and-transition theories (e.g., ecological site capabilities) is a function of both long-term management to promote desirable plant communities and species composition and growth, and annual management of the standing crop to provide cover for sage-grouse (Cagney et al. 2010). Managing solely for towards the capabilities of an ecological site addresses some, but not all of the sagebrush habitat management issues. The potential exists to manage a site for long-term stability within the reference community but fail to achieve sage-grouse habitat objectives. For example, late season and winter livestock use of a site may provide for long-term resilience of the site in the reference state but fail to provide sufficient hiding cover for sage-grouse. Sage-grouse initiate nesting prior to the production of the current year's standing crop of herbaceous vegetation, and as such, residual grasses left from the previous year represent the initial cover available for nesting sage-grouse (Cagney et al. 2010).

The Sage and Columbian Sharp-tailed Grouse Technical Committee (2009) suggest that the scientific evidence supporting the use of prescribed fire for sage-grouse conservation is scant while considerable information documenting negative effects of fire on sage-grouse exists; the authors recommend avoiding the use of prescribed fire in xeric sagebrush habitats. Fischer et al. (1996) reported that the abundance and biomass of ants was reduced the second and third years after treatment. Nelle et al. (2000) reported a significant increase in ant and beetle abundance one year post-treatment, but abundance levels had returned to untreated level within 3 to 5 years. Slater (2003) reported no difference in abundance or biomass between treated and untreated sites. These results suggest treatments may have limited utility as a tool for sage-grouse brood-rearing habitat management. Slater (2003) also reported no difference in nest success probabilities within and outside burn boundaries (35 vs. 20% respectively). Overall nest success in his study (24%) was very low, suggesting potential impacts to nest success at spatial scales larger than actual treatments. Nelle et al. (2000) reported that prescribed fire negatively affected habitat conditions for sage-grouse nesting and brood rearing up to 15 years post-burn. Beck et al. (2009), after investigating the impact to wintering, nesting, and early brood habitat 14 years post-burn, concluded managers should not consider prescribed fire in xeric sagebrush habitats.

Recommendation for Vegetation Management

- **Include habitat parameters specific to sage-grouse when managing vegetation as recommended in Alternative B.**
- **Do not include prescribed fire as a tool for treatments meant to improve habitat conditions for sage-grouse in areas where fire is not being used to specifically target range issues (e.g., cheatgrass)** as proposed in Alternative B.

<u>**Wildland Fire Management**</u>

Summary of DEIS for Wildland Fire Management

Nesting habitats within 3 miles of a lek are prioritized for protection from wildfire under the preferred alternative. Alternative B does not prioritize specific regions within PPMA for wildfire suppression, but identifies all of PPMA as high priority, and areas in PGMA where PPMA is threatened as high priority.

Approximately 80% of female sage-grouse nest within 4 miles of the lek where bred (Colorado Greater Sage-grouse Steering Committee 2008), whereas approximately 62% of females nest within 3 miles of the lek where bred (Holloran and Anderson 2005).

Recommendation for Wildland Fire Management

- Require **a 4-mile lek buffer for wildfire suppression** to encompass a majority of the nesting population.

<u>**Livestock Grazing**</u>

Summary of DEIS for Livestock Grazing

The preferred alternative relies on rangeland health standards and reaching a “suitable rating consistent with the habitat assessment framework” for the implementation of grazing management actions. The preferred alternative includes sage-grouse habitat requirements for the implementation of grazing management actions. Alternative B, in contrast, incorporated sage-grouse habitat requirements for the implementation of grazing management actions.

Analysis of Livestock Grazing

Management of sagebrush habitats for sage-grouse in the context of state-and-transition theories (e.g., ecological site capabilities) is a function of both long-term management to promote desirable plant communities and species composition and growth, and annual management of the standing crop to provide cover for sage-grouse (Cagney et al. 2010).

Managing solely for towards the capabilities of an ecological site addresses some, but not all of the sagebrush habitat management issues. The potential exists to manage a site for long-term stability within the reference community but fail to achieve sage-grouse habitat objectives. For example, late season and winter livestock use of a site may provide for long-term resilience of the site in the reference state but fail to provide sufficient hiding cover for sage-grouse. Sage-grouse initiate nesting prior to the production of the current year's standing crop of herbaceous vegetation, and as such, residual grasses left from the previous year represent the initial cover available for nesting sage-grouse (Cagney et al. 2010).

Recommendation for Livestock Grazing

- **Include sage-grouse specific metrics and indicators as forwarded in Alternative B when assessing livestock grazing management needs.**

<u>Rights-of-Way (ROWs)</u>

Summary of DEIS for ROWs

The preferred alternative maintains PPMAs currently designated as ROW exclusion areas as such, and would manage all other PPMA as ROW avoidance areas. The preferred alternative mentions meteorological towers and stipulates that they must be constructed without guy wires. The preferred alternative relies on sub-regional resource management plans for managing ROWs in PGMA. Alternative B manages all PPMAs as ROW exclusion areas.

Analysis of ROWs

The literature relevant the reaction of sage-grouse to transmission lines is reviewed above.

Despite low numbers of communication towers across the sagebrush biome, sage-grouse lek trends across the range of the species generally increased with distance to nearest communication tower and generally decreased with increasing numbers of towers within 5 km and 18 km of leks (Johnson et al. 2011). The authors surmised that the response of sage-grouse to communication towers may be correlative with human development in general as these types of towers tend to be concentrated along major roadways and near urban centers. However, with the increase in these types of structures throughout the sagebrush biome (e.g., meteorological towers at proposed wind developments), it is worth considering the documented effects.

Recommendation for ROWs

- **Adopt the stipulations for PPMA outlined in the preferred alternative**. Though the scientific literature is currently inconclusive, this approach is may be warranted.
- **Manage communication towers and similar structures under the surface disturbance cap.** However, as research results become available, there may be increased support for establishing all sage-grouse habitat as exclusion areas for ROWs; **the option of changing sage-grouse habitats from avoidance to exclusion areas as information becomes available should be maintained in the DEIS.**

Recreation

The preferred alternative stipulates that particular attention should be paid to recreational activities within 3.2 miles of a lek during the breeding and nesting seasons.

Recommendation for Recreation

- **Require a 6 to 6.4 km (3.7-4 mile) for actions with a high level of recreational activity** to minimize impacts to breeding sage-grouse, and **a 4-mile buffer around leks to encompass a majority of nesting females,** as summarized in Fluid Minerals for activity levels**.**

South Dakota Greater Sage-Grouse Draft RMP/EIS

General Comments

The primary difference between the preferred alternative and alternative C—the alternative in the DEIS most closely aligned with the recommendations forwarded in the NTT report—seems to be in the designation of Protection Priority Areas (PPAs); more habitat is designated as priority habitat under alternative C compared to the preferred alternative. The external border of General Habitats (GH) is the same in both alternatives (see Figures 2-4 vs. 2.5).

Additionally, the administrative flexibility and subjectivity built into Appendix V (*Mitigation Measures and Conservation Actions for Greater Sage-Grouse Habitat*) negates the regulatory mechanisms presented in the appendix. For example, development stipulations for fluid minerals are subject to "environmental constraints," and management actions need to be implemented "to the extent possible," etc. The potential loop-holes provided through this language to prescribed management approaches should be eliminated from the preferred alternative.

Rights-of-Ways (ROWs)

Summary of DEIS for ROWs

The preferred alternative establishes PPAs as avoidance areas for ROWs and exclusion areas for renewable energy ROWs. In GH, the preferred alternative establishes areas within 1 mile of leks as exclusion areas for renewable energy ROWs and avoidance areas for other ROWs. Nesting habitats within 4 miles of leks are avoidance areas for ROWs under the preferred alternative. Under alternative C, PPAs would be exclusion areas for all types of ROWs, and GH areas within 1 mile of leks and nesting habitats with 4 miles of leks would be exclusion areas for all types of ROWs.

Analysis of ROWs

Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggests that these structures may negatively influence sage-grouse habitat selection and survival. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.20 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission line increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors as gas wells. See also discussion under rights-of-way below. Other often cited studies that may provide evidence of impacts of power lines on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data. Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within 2 years, but this study had a sample size of one lek. Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only 2 juvenile grouse were killed by running into power lines.

LeBeau et al. (*in press*) reported that the risk of a nest or a brood failing decreased by 7.1% and 38.1%, respectively, with every 1-km increase in distance from the nearest wind turbine. No variation in female survival was detected relative to wind energy infrastructure (LeBeau et al. *in press*).

Recommendation for ROWs

> **Maintain the option of changing sage-grouse habitats from avoidance to exclusion areas as information in the DEIS.** Because of the inconclusive nature of current research, **avoiding ROWs in sage-grouse habitats as stipulated in the preferred alternative may be sufficient.** However, as research results become available, there may be increased support for establishing sage-grouse habitat as exclusion areas for commercial renewable energy developments and transmission lines.

<u>**Mineral Development**</u>

Summary of DEIS for Mineral Development

The preferred alternative allows for mineral leasing in PPAs, but with a NSO stipulation. Essentially, under the preferred alternative, minerals can be leased in PPAs but must be accessed from infrastructure placed outside of PPA boundaries. PPAs would be closed to fluid, salable and other leasable mineral development, and withdrawn from locatable mineral development under alternative C. Surface disturbing activities would be subject to an avoidance area within 1 mile of sage-grouse leks, and a timing restriction would be established in nesting habitat within 4 miles of leks in GH under the preferred alternative. In addition to adopting these stipulations in GH, alternative C establishes a timing restriction on surface disturbing activities in winter habitats. Mitigation measures and conservation actions for sage-grouse habitat are outlined in detail in Appendix V—both the preferred alternative and alternative C evoke this appendix for the management of sage-grouse (but see *General Comments* above).

Summary of DEIS for Appendix V. Within PPAs, disturbances associated with fluid mineral development would be limited to one site per 640 acres on average, with no more than 3% direct surface disturbance in an analysis area “to the extent possible.” Impacts to breeding and nesting habitats within 4 miles of leks would be minimized “to the extent possible,” and a timing restriction would be placed on exploratory drilling during the nesting and early brood-rearing season. For solid minerals, seasonal timing restrictions are established for nesting, early brood-rearing and winter habitats.

Analysis of Mineral Development
Several authors have reported a distance-effect associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts to lekking sage-grouse of well pads located at shorter distances to leks were more consistently observed across energy fields compared to well pads at longer distances, with a consistent pattern whereby the presence of well pads within smaller radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development to the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species. Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

Research directly relevant to the efficacy of a 1-mile NSO buffer is not available. However, leks that had at least one well pad within 0.4 km (0.25 miles) had 35 to 92% fewer sage-grouse compared to leks with no well pads within this radii (Harju et al. 2010). Walker et al. (2007) reported that implementing a 0.4-km NSO given full field development within the remainder of a 0.8-km- or 3.2-km-radius area would result in lek persistence probabilities of 5% and 24%, respectively.

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse during the winter avoiding the infrastructure of a gas field during the day, but not at night. This suggests that avoidance was of human activity rather than the infrastructure itself. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period. Traffic levels were not measured but increased levels were inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig. These studies would suggest timing restrictions may be effective if human activity around infrastructure in or near seasonal ranges is eliminated or minimized.

Substantial amounts of research suggesting that reducing infrastructure densities around leks will benefit sage-grouse are available. However no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Harju et al. (2010) reported that common well pad densities of 4 and 8 pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below one pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding one well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (8 pads/section). Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the “developed” covariate examined included urban and suburban areas, and interstate and state highways as classified by Landfire (2006) and was quantified within 1-km grid cells. Therefore results may not be comparable to how the stipulations in the DEIS are forwarded.

Recommendation for Mineral Development

- **Adopt the preferred alternative for mineral leasing in PPAs (NSO), as it is supported by the scientific literature**
- **Include a NSO buffer distance of 2 to 4 km for lower activity sites (e.g., producing well pads) and 6 to 6.4 km for higher activity sites (e.g., drilling rigs) around leks, an NSO buffer distance of 2 km around winter range, and an NSO buffer of 1 km around nesting habitats** in GH, as current research supports. **These NSOs should not be clipped to the boundary of any habitat designation (i.e., PPA, GH, or non-habitat).** Neither the preferred alternative nor alternative C contain these stipulations.

- **Institute the NSO buffers recommended above if the goal of the 1-mile NSO in GH is to minimize negative impacts of energy development on sage-grouse populations (rather than for example maintaining lekking habitat integrity), as current research suggests.** The 1-mile NSO should be sufficient to protect the habitats used by male sage-grouse during the breeding season, but will not eliminate indirect effects of energy development.
- **Minimize human activity at infrastructure placed within seasonally protected areas.** Although seasonal timing restrictions are stipulated in the preferred alternative, recommendations forwarded in the literature as well as the NTT report suggest seasonal timing restrictions are ineffective. For example, Best Management Practices presented in Appendix V lists the following for fluid mineral development: "establish trip restrictions or minimization through use of telemetry and remote well control" and "place liquid gathering facilities outside of priority areas"; requiring these practices when developing fluid minerals in priority areas could reduce human activity levels in these areas.
- **Minimize energy development infrastructure densities to one per section averaged across an area designated by a 3- to 3.2-km radius**. A consistently applied surface disturbance threshold is not supported in the literature. If a surface disturbance threshold is to be applied in the preferred alternative as insinuated in Appendix V, it is recommended that **the surface disturbance threshold be established as the proportion of area disturbed by a metric that can be directly related to infrastructure density**—for example, one average sized well pad plus access road directly influences a given number of acres that can be divided by 640 to establish a surface disturbance threshold that is directly relevant the density threshold of one well pad/section reported in the literature. Research suggests that the co-location or clustering of infrastructure reduces impacts of energy development to sage-grouse by reducing the proportion of a landscape indirectly influenced by that infrastructure. Thus, surface disturbance thresholds should be calculated across a larger area than 1 square mile to allow for clustering of infrastructure while maintaining the average one pad/section and surface disturbance threshold.

Invasive Vegetation

Summary and Analysis of Invasive Vegetation

The preferred alternative established a timing restriction to weed management activities that allows only spot treatments within nesting and brood-rearing habitats within 3 miles of leks in general habitats. Alternative C implements the same timing restriction within 4 miles of leks.

Approximately 80% of female sage-grouse nest within 4 miles of the lek where bred (Colorado Greater Sage-grouse Steering Committee 2008), whereas approximately 62% of females nest within 3 miles of the lek where bred (Holloran and Anderson 2005).

Recommendation for Invasive Vegetation

- **Require a 4-mile lek buffer, as established in alternative C,** to encompass a majority of the nesting population.

Fire

Summary of DEIS for Fire

Prescribed fire would be allowed in PPAs under both the preferred alternative and alternative C.

Analysis of Fire

The Sage and Columbian Sharp-tailed Grouse Technical Committee (2009) suggest that the scientific evidence supporting the use of prescribed fire for sage-grouse conservation is scant while considerable information documenting negative effects of fire on sage-grouse exists. The authors recommend avoiding the use of prescribed fire in xeric sagebrush habitats. Fischer et al. (1996) reported that the abundance and biomass of ants was reduced the second and third years after treatment. Nelle et al. (2000) reported a significant increase in ant and beetle abundance one year post-treatment, but abundance levels had returned to untreated level within 3 to 5 years. Slater (2003) reported no difference in abundance or biomass between treated and untreated sites. These results suggest treatments may have limited utility as a tool for sage-grouse brood-rearing habitat management. Slater (2003) reported no difference in nest success probabilities within and outside burn boundaries (35 vs. 20% respectively). Overall nest success in his study (24%) was very low, suggesting potential impacts to nest success at spatial scales larger than actual treatments. Nelle et al. (2000) reported that prescribed fire negatively affected habitat conditions for sage-grouse nesting and brood rearing up to 15 years post-burn. Beck et al. (2009), after investigating the impact to wintering, nesting, and early brood habitat 14 years post-burn, concluded managers should not consider prescribed fire in xeric sagebrush habitats.

Recommendation for Fire

- **Do not include prescribed fire as a tool for treatments meant to improve habitat conditions for sage-grouse in areas where fire is not being used to specifically target range issues (e.g., cheatgrass),** as recommended in the NTT report.

Livestock Grazing

Summary of DEIS for Livestock Grazing

The preferred alternative in general relies upon utilization levels for assessing the impacts of livestock grazing. Alternative B does not differ from the preferred alternative.

Analysis of Livestock Grazing

Management of sagebrush habitats for sage-grouse in the context of state-and-transition theories (e.g., ecological site capabilities) is a function of both long-term management to promote desirable plant communities and species composition and growth, and annual management of the standing crop to provide cover for sage-grouse (Cagney et al. 2010). Managing solely for towards the capabilities of an ecological site addresses some but not all of the sagebrush habitat management issues. The potential exists to manage a site for long-term stability within the reference community but fail to achieve sage-grouse habitat objectives. For example, late season and winter livestock use of a site may provide for long-term resilience of the site in the reference state but fail to provide sufficient hiding cover for sage-grouse because sage-grouse initiate nesting in prior to the production of the current year's standing crop of herbaceous vegetation and as such residual grasses left from the previous year represent the initial cover available for nesting sage-grouse (Cagney et al. 2010).

Recommendation for Livestock Grazing

- **Include sage-grouse specific metrics and indicators when assessing livestock grazing management needs,** as recommended in the NTT report.

Utah Greater Sage-Grouse Draft RMP/EIS

General Comment

In general, the restrictions placed on mineral development under the preferred alternative in the Utah DEIS are less restrictive than those placed on similar development in any of the other DEISs reviewed. However, it is worth noting that the Utah DEIS provides a section—*Management Actions-Anthropogenic*—which details to a degree greater than the other DEISs reviewed, actions being implemented through the preferred alternative for the conservation of sage-grouse. This format clarified management actions under consideration and benefited the structure of the DEIS.

Federal Fluid Mineral Estate

Summary of DEIS for Unleased Federal Fluid Mineral Estate

The preferred alternative allows for fluid mineral leasing in Preliminary Priority Management Areas (PPMAs), but with a NSO stipulation on PPMA within 4 miles of leks, and an NSO on all areas within 1 mile of a lek located within PPMA. Essentially, under the preferred alternative, fluid minerals can be leased in these areas but must be accessed from infrastructure placed outside of these boundaries. Areas within PPMA but beyond 4 miles of a lek located within PPMA are open to leasing subject to the following CSU stipulations: development cannot exceed 5% surface disturbance of the area, seasonal timing restrictions during breeding, brood-rearing and winter seasons, noise restrictions (noise at occupied leks does not exceed 10 dBH above ambient), and tall structure restrictions (man-made structures that have the potential to disrupt lekking or nesting sage-grouse as determined site-specifically). Under the preferred alternative, Preliminary General Management Areas (PGMAs) are open to fluid mineral leasing with an NSO in areas within one mile of leks located within PGMA and otherwise subject to seasonal timing restrictions during breeding, brood-rearing and winter seasons, noise restrictions, and tall structure restrictions. These differ from Alternative B—the alternative in the DEIS most closely aligned with the recommendations forwarded in the NTT report—in that Alternative B closes PPMA to fluid mineral leasing. PGMAs were not addressed in Alternative B. PPMA in Utah was initially delineated by buffering leks by 4 miles and generating polygons of those merged buffers that included large proportions of males based on 1999-2008 lek counts (see Doherty et al. 2011); these initial polygons were then refined based on telemetry information and local knowledge.

Summary of DEIS for *Leased* Federal Fluid Mineral Estate

The preferred alternative applies a 5% surface disturbance cap on fluid mineral development in PPMAs and PGMAs. Alternative B does not allow new surface occupancy in PPMAs unless the entire lease is within PPMA, in which case a 4-mile NSO is applied and surface disturbance is limited to one per section with no more than 3% surface disturbance in that section.

Analysis of Federal Fluid Mineral Estate

Several authors have reported a “distance-effect” associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts to lekking sage-grouse of well pads located at shorter distances to leks were more consistently observed across energy fields compared to well pads at longer distances, with a consistent pattern whereby the presence of well pads within smaller radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development to the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species. Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

Research directly relevant to the efficacy of 1-mile NSO buffer is not available. However, leks that had at least one well pad within 0.4 km (0.25 miles) had 35 to 92% fewer sage-grouse compared to leks with no well pads within this radii (Harju et al. 2010). Walker et al. (2007) reported that implementing a 0.4-km NSO given full field development within the remainder of a 0.8-km- or 3.2-km-radius area would result in lek persistence probabilities of 5% and 24%, respectively.

Substantial research suggests that reducing infrastructure densities around leks will benefit sage-grouse. However, no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Harju et al. (2010) reported that common well pad densities of 4 and 8 pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below one pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding one well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (8 pads/section).

Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the “developed” covariate examined included urban and suburban areas, and interstate and state highways as classified by Landfire (2006) and was quantified within 1-km grid cells. Therefore, results may not be comparable how the stipulations in the DEIS are forwarded.

It is worth noting that the potential benefits of co-location or clustering infrastructure of energy developments as established as an RDF in the DEIS may be non-compatible with the per section surface disturbance thresholds as forwarded in Alternative B where permitted disturbances are limited to one per section with no more than 3% surface disturbance in that section. Limiting disturbance to one well pad/infrastructure and 3% surface disturbance per section as established in Alternative B, unless quantified as an average across a larger landscape, will counteract and contradicts the requirement of clustering infrastructure. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al. (2007) found that gas development—measured as the proportion of area around a lek within 350 m of the infrastructure of a gas field—within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities.

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse during the winter avoiding the infrastructure of a gas field during the day, but not at night. This suggests that avoidance was of human activity rather than the infrastructure itself. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period. Traffic levels were not measured but increased levels were inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig. These studies would suggest timing restrictions may be effective if human activity around infrastructure in or near seasonal ranges is eliminated or minimized.

Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggests that these structures may negatively influence sage-grouse habitat selection and survival—research relevant the tall structure restrictions applied under the preferred alternative. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.20 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission line increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors, as gas wells. Other often cited studies that may provide evidence of impacts of tall structures on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data. Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within 2 years, but this study had a sample size of one lek. Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only 2 juvenile grouse were killed by running into power lines.

Recommendation for Federal Fluid Mineral Estate

- **Adopt the preferred alternative, as it is generally supported by scientific literature for fluid mineral leasing in PPMAs (e.g. a 4-mile buffer around leks).** However, modifications to PPMA boundaries may have resulted in areas not covered under the NSO being relatively close to leks and or other seasonal habitats, as evidenced by the 1-mile NSO around leks situated near PPMA boundaries stipulated in the preferred alternative. **Consider including all areas, regardless of habitat designation, within 2 to 4 km of a lek NSO for lower activity sites (e.g., producing well pads) and all areas within 6 to 6.4 km of a lek NSO for higher activity sites (e.g., drilling rigs). Additionally, consider restricting fluid mineral development in all areas, regardless of habitat designation, within 2 km of winter range and within 1 km of nesting habitats.** These suggestions are in addition to the NSO established in PPMAs in the preferred alternative.
- **Implement the NSO buffers recommended directly above for PPMAs and PGMAs if the goal of the preferred alternative's 1-mile NSO for leks near the boundary of PPMAs and in PGMAs is to minimize negative impacts of energy development on sage-grouse populations** (rather than for example maintaining lekking habitat integrity). The 1-mile

NSO should be sufficient to protect the habitats used by male sage-grouse during the breeding season, but will not eliminate indirect effects of energy development.

- **Minimize human activity at infrastructure placed within seasonally protected areas.** Although seasonal timing restrictions are stipulated in the preferred alternative, recommendations forwarded in the literature as well as the NTT report suggest seasonal timing restrictions are ineffective. For example, Appendix J (*Required Design Features for Fluid Minerals*) lists the following as RDFs for fluid mineral development: "establish trip restrictions or minimization through use of telemetry and remote well control" and "place liquid gathering facilities outside of priority areas"; requiring these practices when developing fluid minerals in priority areas could reduce human activity levels in these areas.
- **Minimize energy development infrastructure densities to 1 per section averaged across an area designated by a 3- to 3.2-km radius, as research supports.** A consistently applied surface disturbance threshold is not supported in the literature. If a surface disturbance threshold is to be applied in the preferred alternative, it is recommended that **the surface disturbance threshold be established as the proportion of area disturbed by a metric that can be directly related to infrastructure density**—for example, 1 average sized well pad plus access road directly influences a given number of acres that can be divided by 640 to establish a surface disturbance threshold that is directly relevant the density threshold of 1 well pad/section reported in the literature. Research suggests that the co-location or clustering of infrastructure reduces impacts of energy development to sage-grouse by reducing the proportion of a landscape indirectly influenced by that infrastructure. Thus, **surface disturbance thresholds should be calculated across a larger area than 1 square mile to allow for clustering of infrastructure while maintaining the average 1 pad/section and surface disturbance threshold**. It is worth noting that the preferred alternative provides a detailed description on calculating surface disturbance proportions, and that this is accomplished across a larger area than a square mile.
- Because of the inconclusive nature of current research, **the tall structure restriction as stipulated in the preferred alternative may be sufficient.**

<u>Coal</u>

Summary of DEIS for Coal—Unleased

The preferred alternative allows for surface coal mining of PPMA and PGMA with the following stipulations: total disturbance cannot exceed 5% surface disturbance of the area, seasonal timing restrictions during breeding, brood-rearing and winter seasons on "initial activity within the development", and noise and tall structure restrictions (as described for fluid minerals). Underground mining would be allowed in PPMA under the preferred alternative with the following stipulations: appurtenant facilities placed outside of PPMAs unless technologically infeasible—in which case, a 1-mile NSO is applied to leks located in PPMA. Surface disturbance, timing, noise and tall structure restrictions apply to underground mining. PGMA is open to underground coal mining under the preferred alternative. Surface coal mining is not allowed in PPMA under Alternative B, and underground coal mining is allowed in PPMA if all surface disturbing activities are placed outside the boundary of PPMA.

Summary of Coal—Leased
For underground coal mining in PPMAs, new appurtenant facilities would be placed outside of PPMA unless technologically infeasible—in which case facilities would be located in existing disturbance. In PGMA, the preferred alternative states that "effective" mitigation would be used to offset impacts. Stipulations applied by Alternative B are the same as those for the preferred alternative.

Analysis of Coal
The literature reviewed and recommendations forwarded for fluid mineral development apply here.

Although the premise of implementing "effective" mitigation to offset impacts is on the surface sound, it is extremely important to note that the enhancement or restoration of sagebrush-habitats is not a trivial task. There is tremendous uncertainty as to the vegetative and sage-grouse population outcomes of habitat manipulations (Johnson and Holloran 2010). Managers often justify habitat manipulations with potential long-term benefits, but the long-term effects to habitats and consequences to sage-grouse of most of the available habitat manipulation options are unknown. Extreme caution and discretion should be employed when proposing habitat treatments, especially on drier sites, sites where cheatgrass may invade, and sites with limited potential to produce sagebrush (e.g., the interface between the Wyoming Basin and the Great Plains; Cagney et al. 2010). Although mitigation plans should be developed at landscape spatial scales, development at these scales does not necessitate that treatments be implemented across these scales. A small-scale, case-by-case treatment regime conducted over the long term should be implemented. The plan needs to be generated rigorously from an analysis of all available information, and should set in motion a process whereby data from implemented actions are used to inform future actions in an iterative cycle where management actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The iterative evaluation is extremely important given the uncertainty surrounding sagebrush habitat management, and needs to be the central theme of implementation of any adaptive management plan.

Recommendation for Coal

- **Add language establishing the uncertainty surrounding enhancement of sagebrush habitats with treatment.**
- **Further develop Appendix F (*Regional Mitigation Strategy*) into a resource that would benefit energy developers considering development in PPMA or PGMA.** The mitigation strategy needs to be generated from an analysis of all available information, include projections of the vegetative and sage-grouse population response to potential management actions, outline specific pre and post-treatment monitoring requirements, and should set in motion a process whereby data from implemented actions are used to inform future actions in an iterative cycle where mitigation actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The adaptive context established by a mitigation plan iteratively

evaluated is extremely important given the uncertainty surrounding sagebrush habitat management.

<u>Non-energy Leasable Minerals (including BMPs and RDFs)</u>

Summary of DEIS for Non-energy Leasable Minerals

PPMAs would be closed to leasing for surface mining of non-energy leasable minerals under the preferred alternative. In addition, leases outside of PPMA but within 4 miles of a lek located in PPMA would be subject to the noise and tall structures restrictions. Underground mining would be allowed in PPMAs under the preferred alternative with new appurtenant facilities being placed outside of PPMA unless technologically infeasible—in which case facilities would be located in existing disturbance given a 1-mile NSO of leks within PPMA and noise restrictions. Under the preferred alternative, new surface mines in PGMAs would be subject to a 1-mile NSO buffer around leks located within PGMA, and new underground mining leases would be allowed in PGMA. Alternative B closes PPMAs to non-energy leasable mineral leasing, and does not address PGMA. Existing leases in PPMA would be allowed to be developed under both the preferred alternative and Alternative B with Best Management Practices (BMPs) and Required Design Features (RDFs) being applied.

The information and recommendations forwarded under Fluid Minerals above apply here.

Summary of DEIS for BMPs and RDFs (Appendix I)

Recommendations in Appendix I include limiting activity levels and vehicle speeds on roads, clustering and minimizing amounts of infrastructure, anti-perching devices on above ground facilities to discourage nesting of raptors and corvids, and controlling the spread of West Nile virus (WNv) through the design of surface water disposal structures.

Analysis of Non-energy Leasable Minerals

Much of the pertinent literature has been reviewed above in the section titled Federal Fluid Mineral Estate.

Sage-grouse avoidance of high-activity roads is well documented. Connelly et al. (2004) found that no leks occurred within 2 km of Interstate 80, there were fewer leks within 7.5 km than within 15 km of the interstate, and there were higher rates of decline in lek counts between 1970 and 2003 on leks located within compared to beyond 7.5 km of the interstate. Knick et al. (2013) reported that high habitat suitability was associated with <1.0 km/km^2 of secondary roads, 0.05 km/km^2 of highways, and 0.01 km/km^2 of interstate highways within 5-km-radius areas. LeBeau (2012) found that sage-grouse avoided nesting and summering near major roads (e.g., paved secondary highways). Tack (2009) found negative relationships with more roads around leks at all levels of lek attendance, but impacts were greatest for larger leks (>25 males); the probability of occurrence of a large lek was 50% with road densities of approximately 25 km of road within 3.2 km of a lek. Dzialak et al. (2012) documented sage-grouse during the winter avoiding haul roads associated with natural gas development. In contrast, results from some of the smaller road categories Johnson et al. (2011) found negative trends with distance to interstate highway—although few leks occurred near interstates; relatively consistent slight negative trends with distance to highways; and no relationship between distance to secondary roads and lek trends. Road densities within a 5-km radius of leks suggested similar relationships by road category (Johnson et al. 2011).

Restrictions on the volume of vehicle traffic on roads in sage-grouse habitats as a means of reducing the impacts of roads to sage-grouse are supported management actions. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period; traffic speed was not measured but the potential for increased speed was inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes and that vehicle activity on roads within 3 km of leks during the time of day sage-grouse were present on leks influenced the number of males on leks more negatively than leks where roads within 3 km had no vehicle activity during the strutting period. Lyon and Anderson (2003) reported that traffic disturbance (1 to 12 vehicles/day) within 3 km of leks during the breeding season reduced nest-initiation rates and increased distances moved from leks during nest site selection by female sage-grouse breeding on those leks. Blickley et al. (2012) reported that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise such as that from a drilling rig.

Slater and Smith (2008) reported that perch deterrents reduced the occurrence of corvids and raptors relative to a control (non-deterred) line, but that perching was not entirely prevented. Lammers and Collopy (2007) found that perch deterrents reduced the probability of a raptor or corvid perching on a power pole and reduced the duration of perching, but they also reported that perching was not entirely prevented by perch deterrents. In contrast, Prather and Messmer (2010) found that perch deterrents were ineffective at reducing the number of perch-events of raptors and corvids.

Presently, sage-grouse lack resistance to West Nile virus (WNv) and exposure to the virus results in 100% mortality (Clark et al. 2006). It is worth noting that given relationships between temperature, water and WNv, climate change, if resulting in higher temperatures and drier summer conditions in the western U.S. as most models predict, may increase impacts of WNv on sage-grouse populations.

Recommendations for Non-energy Leasable Minerals

- **Require seasonal closures of roads within sage-grouse habitats and establish an NSO for roads around leks.**
- **Strengthen the WNv BMP to include the requirement that anthropogenic water sources be eliminated in sage-grouse habitats that cannot be managed to exclude habitats suitable for *Cx. tarsalis* mosquitoes.** For example, use WNv prevention measures for water impoundments or developments for livestock and/or wild horses and burros.

- **Avoid substituting anti-perching devices for burial or elimination of power lines to maintain sage-grouse habitats** because perch-deterrents reduce but do not eliminate perching on power poles by raptors and corvids.

<u>**Locatable Minerals**</u>

Summary of DEIS for Locatable Minerals

Under the preferred alternative, PPMAs and PGMAs would be open to locatable mineral leasing with the following limitations “to the extent consistent with the rights of a mining claimant under existing laws and regulations”: total surface disturbance cannot exceed 5% of the area and onsite and off-site mitigation would be used to offset impacts to sage-grouse. Alternative B would close PPMAs to locatable minerals development. The BMPs/RDFs listed above would apply for the development of already leased minerals under both alternatives.

The administrative flexibility and subjectivity built into the preferred alternative negates the regulatory mechanisms presented as RDFs.

<u>**Mineral Materials**</u>

Summary of DEIS for Mineral Materials

Under the preferred alternative, PPMA and PGMA are open to mineral material sales/development with the following restrictions: NSO within 1 mile of leks located in PPMA, 5% surface disturbance cap, seasonal timing restrictions, new developments to be located in disturbed habitats or within 0.25 miles of an existing road, and noise and tall structure restrictions. In PGMAs the same stipulations apply except there is no mention of locating disturbance in already disturbed habitats or within 0.25 miles of an existing road. It is worth noting that stipulations can be waived (except for the timing restrictions) if off-site mitigation is successfully completed in PPMAs. PPMAs are closed to mineral material sales under Alternative B.

Although discussed at length above, it is worth reiterating that even though the premise of waiving stipulations in instances of effective mitigation is well-meaning, tremendous uncertainty exists as to the vegetative and sage-grouse population outcomes of habitat treatments, especially over the long term. Effective enhancement of sagebrush habitats for sage-grouse is not a trivial task.

The literature reviewed and recommendations forwarded for energy and mineral development apply here.

<u>**Rights-of-Way (ROWs)**</u>

Summary of DEIS for ROWs

Under the preferred alternative, PPMA within 4 miles of leks located in PPMA would be managed as exclusion areas for transmission and distribution lines. Beyond 4 miles of a lek but within PPMA, areas would be managed as transmission and distribution line avoidance areas. Areas within 1 mile of leks in PPMA would be managed as exclusion areas for structures such as communication towers, while areas beyond 1 mile of a lek but in PPMA would be managed as avoidance areas for these structures. In PGMAs, areas within 1 mile of leks located in PPMA would be managed as ROW exclusion areas, and areas within 1 mile of leks located in PGMA would be managed as ROW avoidance areas. Under Alternative B, PPMAs would be managed as ROW exclusion areas and PGMAs would be managed as ROW avoidance areas.

Analysis of ROWs

The literature relevant to the reaction of sage-grouse to transmission lines is reviewed above.

Despite low numbers of communication towers across the sagebrush biome, sage-grouse lek trends across the range of the species generally increased with distance to nearest communication tower and generally decreased with increasing numbers of towers within 5 km and 18 km of leks (Johnson et al. 2011). The authors surmised that the response of sage-grouse to communication towers may be correlative with human development in general as these types of towers tend to be concentrated along major roadways and near urban centers. However, with the increase in these types of structures throughout the sagebrush biome (e.g., meteorological towers at proposed wind developments), it is worth considering the documented effects.

Recommendation for ROWs

- **Consider option of changing sage-grouse habitats from avoidance to exclusion areas.** Because of the inconclusive nature of current research, **the stipulations for PPMA and PGMA outlined in the preferred alternative may be sufficient.** However, as research results become available, there may be increased support for establishing all sage-grouse habitat as exclusion or avoidance areas for ROWs.
- **Manage communication towers and similar structures under the surface disturbance cap.**

<u>Renewable Energy</u>

Summary of DEIS for Renewable Energy

The preferred alternative designates areas within 1 mile of leks within PPMA as exclusion areas for wind development, and areas within 4 miles of leks within PPMA as avoidance areas for wind development. PPMAs are exclusion areas for wind energy development under Alternative B.

Analysis of Renewable Energy

LeBeau et al. (*in press*) reported that the risk of a nest or a brood failing decreased by 7.1% and 38.1%, respectively, with every 1-km increase in distance from the nearest wind turbine. No variation in female survival was detected relative to wind energy infrastructure (LeBeau et al. *in press*).

Recommendation for Renewable Energy

- **Maintain the option of changing sage-grouse habitats from avoidance to exclusion in the DEIS**. Because of the lack of directly pertinent research, **the stipulations for sage-grouse habitats outlined in the preferred alternative may be sufficient.** However, as research results become available, there may be increased support for establishing sage-grouse habitat as exclusion areas for commercial wind energy developments**.**

Fire

Summary of DEIS for Fire

The preferred alternative allows for a variety of treatment methods—including prescribed fire—to be used for treating sagebrush communities and sage-grouse habitats. Alternative B does not allow prescribed fire in sage-grouse habitats.

Analysis of Fire

The Sage and Columbian Sharp-tailed Grouse Technical Committee (2009) suggest that the scientific evidence supporting the use of prescribed fire for sage-grouse conservation is scant while considerable information documenting negative effects of fire on sage-grouse exists. The authors recommend avoiding the use of prescribed fire in xeric sagebrush habitats. Fischer et al. (1996) reported that the abundance and biomass of ants was reduced the second and third years after treatment. Nelle et al. (2000) reported a significant increase in ant and beetle abundance 1 year post-treatment, but abundance levels had returned to untreated level within 3 to 5 years. Slater (2003) reported no difference in abundance or biomass between treated and untreated sites. These results suggest treatments may have limited utility as a tool for sage-grouse brood-rearing habitat management. Slater (2003) reported no difference in nest success probabilities within and outside burn boundaries (35% vs. 20% respectively). Overall nest success in his study (24%) was very low, suggesting potential impacts to nest success at spatial scales larger than actual treatments. Nelle et al. (2000) reported that prescribed fire negatively affected habitat conditions for sage-grouse nesting and brood rearing up to 15 years post-burn. Beck et al. (2009), after investigating the impact to wintering, nesting, and early brood habitat 14 years post-burn, concluded managers should not consider prescribed fire in xeric sagebrush habitats.

Recommendation for Fire

- **Do not include prescribed fire as a tool for treatments meant to improve habitat conditions for sage-grouse in areas where fire is not being used to specifically target range issues (e.g., cheatgrass)** as proposed in Alternative B.

Big Horn Basin (WY) Draft RMP/EIS

General Observation

It was difficult to discern what management actions were being established in this DEIS. Several seeming inconsistencies were noted. For example, the preferred alternative establishes both a NSO and timing restrictions for unleased areas within 0.6 miles of leks in key habitat areas; and under both alternatives investigated, 3% as well as 5% surface disturbance thresholds were established in different areas of the document. Both examples of apparent inconsistencies are pointed out in the Fluid Minerals Leased section below.

"Key habitat areas" in this DEIS referred to the priority habitats identified, which are a combination of Wyoming-state-identified core areas version 2 and version 3 modified with local knowledge (see Figure Q.1 Page 1875 in DEIS).

Fluid Minerals

Summary of DEIS for Fluid Minerals—Unleased

The preferred alternative establishes a 0.6-mile NSO stipulation around leks (occupied and undetermined) in key habitat areas. Minimum lease size in key habitat areas is 640 acres (1 square mile)—this is assumed to be a technique to facilitate the co-location of infrastructure as it is similar to the potential effects of unitization. This differs from Alternative B—the alternative in the DEIS most closely aligned with the recommendations forwarded in the NTT report—in that key habitat areas are administratively unavailable for fluid mineral leasing. Under the preferred alternative, a timing restriction on disruptive activities is additionally applied to lands within 0.6 miles of leks. Given that these stipulations are pertinent to unleased fluid minerals, a timing restriction is not needed if an NSO is enforced. Key habitat areas in WY were initially delineated by buffering leks and lek complexes by 4 miles and generating polygons of those merged buffers that included large proportions of males based on 2005-07 lek counts (see Doherty et al. 2011); these initial polygons were then refined based on local knowledge and negotiations by a state-led commission.

Analysis of Fluid Minerals—Unleased

Research directly relevant to the efficacy of 0.6-mile NSO buffer is not available. However, leks that had at least 1 well pad within 0.4 km (0.25 miles) had 35% to 92% fewer sage-grouse compared to leks with no well pads within this radii (Harju et al. 2010). Walker et al. (2007) reported that implementing a 0.4-km NSO given full field development within the remainder of a 0.8-km- or 3.2-km-radius area would result in lek persistence probabilities of 5% and 24%, respectively.

Unitization provides for the exploration, development, and operation of a geologically defined area by a single operator making phased and/or clustered development more tenable. Unitization may benefit sage-grouse by resulting in the co-location or clustering of infrastructure for energy development. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure.

Walker et al. (2007) found that gas development within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities; gas development in this study was measured as the proportion of area around a lek within 350 m of gas field infrastructure—in other words the proportion of a 0.8-km-radius area around a lek within 350 m of infrastructure.

The potential indirect effects of infrastructure on sage-grouse were not addressed by the preferred alternative. Several authors have reported a "distance-effect" associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that effects on lekking sage-grouse of well pads located at shorter distances to leks were more consistently observed across energy fields compared with well pads at longer distances, with a consistent pattern whereby the presence of well pads within smaller radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development to the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species. Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

Recommendation Fluid Minerals—Unleased

- **Adopt the stipulations in Alternative B because they are supported by the scientific literature as compared to the preferred alternative.** The stipulations forwarded under the preferred alternative are similar to those that have been associated with energy developments to-date, and have been shown to be ineffective. Given the process for delineating key habitat areas in Wyoming (e.g., a 4-mile buffer around leks), indirect effects of energy development to sage-grouse on leks should in general be minimized by the NSO stipulation forwarded in **Alternative B, which should be adapted in this case**. However, modifications to key habitat area boundaries may have resulted in areas not covered under the NSO being relatively close to leks and or other seasonal habitats. **Consider including all areas, regardless of habitat designation, within 2 to 4 km of a lek**

NSO for lower activity sites (e.g., producing well pads) and all areas within 6 to 6.4 km of a lek NSO for higher activity sites (e.g., drilling rigs). Additionally consider restricting fluid mineral development in all areas, regardless of habitat designation, within 2 km of winter range and within 1 km of nesting habitats.

Fluid Minerals—Leased

Summary of DIES for Fluid Minerals—Leased

The preferred alternative establishes a 0.6-mile NSO Condition of Approval (COA) around leks in key habitat areas. Timing restrictions not allowing disruptive activity are also applied within 0.6 miles of leks (an apparent inconsistency with the 0.6 NSO) in addition to suitable nesting and early brood-rearing habitats, and to winter concentration areas in key habitat areas as COAs. Unitization is required when deemed necessary. Outside key habitat areas, the preferred alternative establishes a 0.25-mile NSO around leks, timing restrictions within 0.25 miles of leks—an apparent inconsistency, timing restrictions in suitable nesting and early brood-rearing habitats within 2 miles of leks, and timing restrictions in winter concentration areas. The preferred alternative establishes a cap of 1 energy production location and/or transmission structure per section (640 acres) with a cumulative surface disturbance cap of 5% within that section. Alternative B applies a NSO to key habitat areas; in the event that an entire lease is within key habitat areas, a 4-mile NSO would be applied around leks and surface disturbance would be limited to one per section with no more than 3% surface disturbance in that section. Timing restrictions not allowing disruptive activity are applied within 0.6 miles of leks, to suitable nesting and early brood-rearing habitats within 3 miles of leks, and to winter concentration areas in key habitat areas under Alternative B. It is worth noting that under Special Status Species—sage-grouse, a 5% surface disturbance threshold is established under Alternative B—an apparent inconsistency. Both alternatives allow for the consideration of an exception to COAs given effective mitigation.

Analysis of Fluid Minerals—Leased

The probable ineffectiveness of 0.25 and 0.6-mile NSOs around leks as a means of maintaining lek activity is discussed at length above. The potential benefits of unitization are also discussed above.

Substantial amounts of research suggest that reducing infrastructure densities around leks will benefit sage-grouse. However, no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Harju et al. (2010) reported that common well pad densities of 4 and 8 pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below 1 pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding 1 well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared with areas with 12.3 pads (8 pads/section).

Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the "developed" covariate examined included urban and suburban areas, and interstate and state highways as classified by Landfire (2006) and was quantified within 1-km grid cells. Therefore, results may not be comparable to the stipulations in the DEIS.

It is worth noting that the potential benefits of co-location or clustering infrastructure (a major component of the preferred alternative) may be non-compatible with a per-section surface disturbance threshold as forwarded in the preferred alternative where permitted disturbances are limited to one per section with no more than 5% surface disturbance in that section. Limiting disturbance to one well pad/infrastructure and 5% surface disturbance per section as established in the preferred alternative, unless quantified as an average across a larger landscape, will counteract and contradicts the requirement of clustering infrastructure. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al. (2007) found that gas development—measured as the proportion of area around a lek within 350 m of the infrastructure of a gas field—within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities.

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse during the winter avoiding the infrastructure of a gas field during the day, but not at night. This suggests that avoidance was of human activity rather than the infrastructure itself. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period; traffic levels were not measured but increased levels were inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes. Blickley et al. (2012) reported that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig. These studies would suggest timing restrictions may be effective if human activity around infrastructure in or near seasonal ranges is eliminated or minimized.

Approximately 80% of female sage-grouse nest within 4 miles of the lek where they were bred (Colorado Greater Sage-Grouse Steering Committee 2008), whereas approximately 62% of females nest within 3 miles of the lek where they were bred (Holloran and Anderson 2005).

Although the premise of the stipulation forwarded in the alternatives that COAs can be waived given effective mitigation is on the surface sound, the enhancement or restoration of sagebrush habitats is not a trivial task. There is tremendous uncertainty as to the vegetative and sage-grouse population outcomes of habitat manipulations (Johnson and Holloran 2010). Managers often justify habitat manipulations with potential long-term benefits, but the long-term effects to habitats and consequences to sage-grouse of such habitat manipulation options are largely unknown. Extreme caution and discretion should be employed when proposing a habitat treatment, especially on drier sites, sites where cheatgrass may invade, and sites with limited potential to produce sagebrush (e.g., the interface between the Wyoming Basin and the Great Plains; Cagney et al. 2010). Some treatments may be prudent to address habitat degradation because habitat degradation is a significant causal factor in sage-grouse declines (see Connelly et al. 2004). However, a conservative or limited approach to proactive habitat manipulations is warranted because we do not have all, or even many, of the answers when it comes to improving sagebrush habitat conditions for sage-grouse. Although mitigation plans should be developed at landscape spatial scales, development at this scale does not necessitate that treatments be implemented across these scales. A small-scale, case-by-case treatment regime conducted over the long term should be implemented. Connelly et al. (2000)—in the sage-grouse habitat management guidelines—recommend that no more than 20% of the nesting, early brood-rearing and wintering habitats (in combination) in a landscape be in a treated state at any one time; recovery from treatment should be considered ≥12% canopy cover in Wyoming big sagebrush and ≥15% in mountain big sagebrush-dominated areas.

Recommendation for Fluid Minerals—Leased

- **Calculate infrastructure density thresholds across a larger area than 1 square mile to allow for clustering of infrastructure while maintaining an average of 1 pad/section across the larger analysis area. Alternative B is supported by the scientific literature**. Research supports the minimization of energy development infrastructure densities to 1 per section averaged across an area designated by a 3- to 3.2-km radius. Research suggests that the co-location or clustering of infrastructure reduces impacts of energy development to sage-grouse by reducing the proportion of a landscape indirectly influenced by that infrastructure.
- **Include a technique for limiting infrastructure densities that allows for and encourages the clustering or co-locating of infrastructure on the landscape.** It is worth noting that the 5% anthropogenic surface disturbance threshold, if calculated at the scale of a square mile, will not alleviate the need to address co-location. Additionally, an explicit

surface disturbance threshold where impacts to sage-grouse are minimized is not available in the literature.

- **Minimize human activity at infrastructure placed within seasonally protected areas**. Although seasonal timing restrictions are stipulated in the preferred alternative, recommendations forwarded in the literature as well as the NTT report suggest seasonal timing restrictions are ineffective. For example, establishing trip restrictions in energy fields and placing liquid gather facilities outside of key habitat areas, as suggested in the NTT report, could reduce human activity levels in these areas. Additionally, to encompass a majority of the nesting population, **a 4-mile lek buffer is required for implementation of timing restrictions**.
- **Add language to the preferred alternative establishing the uncertainty surrounding enhancement of sagebrush habitats with treatment. Additionally, consider adding a region-wide habitat management plan that addresses site-specific actions in the context of the landscape as an appendix** to the DEIS. The plan needs to be generated from an analysis of all available information, include projections of the vegetative and sage-grouse population response to potential management actions, outline specific pre- and post-treatment monitoring requirements, and should set in motion a process whereby data from implemented actions are used to inform future actions in an iterative cycle where mitigation actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The adaptive context established by a mitigation plan iteratively evaluated is extremely important given the uncertainty surrounding sagebrush habitat management.

Habitat Management

Summary of DEIS for Habitat Management

In the preferred alternative, the creation of small openings in continuous or dense sagebrush using a variety of treatments is stipulated for maintaining a mosaic of multiple age classes and understory diversity. The example used was the thinning of sagebrush to increase forbs in early brood-rearing habitat. The reintroduction of appropriate fire regimes is stipulated in the preferred alternative, with the specific example being to limit conifer encroachment into the sagebrush plant communities.

Analysis of Habitat Management

Sage-grouse broods select relatively dense sagebrush stands between hatch and 2 weeks post-hatch, presumably for thermal and predator protection of young chicks (Thompson et al. 2006). Baker (2011) reported that the best available estimates of fire rotation (i.e., the expected time to burn once through a land area equal to that of a landscape of interest) averaged 200-350 years in Wyoming big sagebrush (xeric landscapes) and 150-300 years in mountain big sagebrush (more mesic sagebrush communities). Baker (2006) concluded that fire exclusion likely has had little effect in most sagebrush communities, and that the reintroduction of fire into these systems is currently not a restoration need. Lommasson (1948), after studying sagebrush stands for 31 years (1915-45) in Montana, concluded that sagebrush will continue to reproduce and maintain itself indefinitely under natural conditions; over time, sites favorable for sagebrush growth will eventually become (and be maintained in) a multi-aged stand.

Recommendation for Habitat Management

- **Implement treatments aimed at enhancing sage-grouse early brood-rearing habitats only in situations where it has been empirically demonstrated that early brood-rearing habitat availability is limited and such treatments directly address habitat parameters.**
- **Do not include prescribed fire as a tool for treatments meant to improve habitat conditions for sage-grouse in areas where fire is not being used to specifically target range issues (e.g., cheatgrass or wildfire).**

Rights-of-Way

Summary of DEIS for Rights-of-Way (ROW)

The preferred alternative manages key habitat areas as ROW mitigation areas. Infrastructure associated with ROWs is managed under the 5% surface disturbance cap mentioned above under leased fluid minerals with NSO and timing restrictions, also mentioned above, enforced for ROW developments. High profile structures are allowed in key habitat areas on a case-by-case basis. Retrofitting existing structures in key habitat areas with anti-perching devices is established as a management alternative in the preferred alternative. It is worth noting that the preferred alternative also establishes that additional effective mitigation needs be implemented if disturbance associated with ROW development exceeds 3% for an area, providing an apparent contradiction. Key habitat areas are managed as ROW exclusion areas under Alternative B. Communication towers are allowed in key habitat areas under both alternatives.

Analysis of Rights-of-Ways

Despite low numbers of communication towers across the sagebrush biome, sage-grouse lek trends across the range of the species generally increased with distance to nearest communication tower and generally decreased with increasing numbers of towers within 5 km and 18 km of leks (Johnson et al. 2011). The authors surmised that the response of sage-grouse to communication towers may be correlative with human development in general as these types of towers tend to be concentrated along major roadways and near urban centers. However, with the increase in these types of structures throughout the sagebrush biome (e.g., meteorological towers at proposed wind developments), it is worth considering the documented effects.

Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggests that these structures may negatively influence sage-grouse habitat selection and survival. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.20 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission line increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors as gas wells. See also discussion under rights-of-way below. Other, often cited studies that may provide evidence of impacts of power lines on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data. Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within 2 years, but this study had a sample size of one. Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only 2 juvenile grouse were killed by running into power lines.

Slater and Smith (2008) reported that perch deterrents reduced the occurrence of corvids and raptors relative to a control (non-deterred) line, but that perching was not entirely prevented. Lammers and Collopy (2007) found that perch deterrents reduced the probability of a raptor or corvid perching on a power pole and reduced the duration of perching, but they also reported that perching was not entirely prevented by perch deterrents. In contrast, Prather and Messmer (2010) found that perch deterrents were ineffective at reducing the number of perch-events of raptors and corvids.

Recommendation for Rights-of-Way

- **Institute stipulations in Alternative B because they are generally supported by the scientific literature as compared to the preferred alternative**. Although current research is inconclusive, **the evidence is suggestive enough to warrant key habitat areas being avoidance or exclusion areas for ROW.**
- **Manage communication towers and similar structures under the surface disturbance cap.**
- **Avoid substituting anti-perching devices for burial or elimination of power lines** to maintain key habitats because perch-deterrents reduce but do not eliminate perching on power poles by raptors and corvids.

Motorized Vehicles

Summary of DEIS for Motorized Vehicles

Motorized vehicle restrictions are not established under the preferred alternative. New primary and secondary roads are to be placed >1.9 miles from leks, and tertiary roads >0.6 miles from leks in key habitat areas in the preferred alternative. In contrast, Alternative B establishes seasonal closures to motorized vehicles in key habitat areas, and prohibits the construction of new roads within 4 miles of sage-grouse leks in key habitat areas.

Analysis of Motorized Vehicles

Sage-grouse avoidance of high-activity roads is well documented. Connelly et al. (2004) found that no leks occurred within 2 km of Interstate 80, there were fewer leks within 7.5 km than within 15 km of the interstate, and there were higher rates of decline in lek counts between

1970 and 2003 on leks located within, compared to beyond, 7.5 km of the interstate. Knick et al. (2013) reported that high habitat suitability was associated with <1.0 km/km^2 of secondary roads, 0.05 km/km^2 of highways, and 0.01 km/km^2 of interstate highways within 5-km-radius areas. LeBeau (2012) found that sage-grouse avoided nesting and summering near major roads (e.g., paved secondary highways). Tack (2009) found negative relationships with more roads around leks at all levels of lek attendance, but impacts were greatest for larger leks (>25 males); the probability of occurrence of a large lek was 50% with road densities of approximately 25 km of road within 3.2 km of a lek. Dzialak et al. (2012) documented sage-grouse during the winter avoiding haul roads associated with natural gas development. In contrast, for some of the smaller road categories, Johnson et al. (2011) found negative trends with distance to interstate highway—although few leks occurred near interstates; relatively consistent slight negative trends with distance to highways; and no relationship between distance to secondary roads and lek trends. Road densities within a 5-km radius of leks suggested similar relationships by road category (Johnson et al. 2011).

As noted above, restrictions on the volume of vehicle traffic on roads in sage-grouse habitats as a means of reducing the impacts of roads to sage-grouse are supported management actions. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period. Traffic speed was not measured but the potential for increased speed was inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes and that vehicle activity on roads within 3 km of leks during the time of day sage-grouse were present on leks influenced the number of males on leks more negatively than leks where roads within 3 km had no vehicle activity during the strutting period. Lyon and Anderson (2003) reported that traffic disturbance (1 to 12 vehicles/day) within 3 km of leks during the breeding season reduced nest-initiation rates and increased distances moved from leks during nest site selection of female sage-grouse breeding on those leks. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig.

Recommendation for Motorized Vehicles

- **Adopt Alternative B's seasonal closure language** due to the importance of minimizing human activity at certain times of year. **The 1.9 mile buffer distance for primary and secondary roads, as outlined in the preferred alternative**, may be sufficient according to scientific literature.

__**Renewable Energy**__

Summary of DEIS for Renewable Energy

Key habitat areas are managed as renewable energy avoidance/mitigation areas under the preferred alternative. Key habitat areas are managed as renewable energy exclusion areas under Alternative B.

Analysis of Renewable Energy

LeBeau et al. (*in press*) reported that the risk of a nest or a brood failing decreased by 7.1% and 38.1%, respectively, with every 1-km increase in distance from the nearest wind turbine. No variation in female survival was detected relative to wind energy infrastructure (LeBeau et al. *in press*).

Recommendation for Renewable Energy

- **Maintain the option of changing sage-grouse habitats from avoidance to exclusion in the DEIS.** Because of the lack of directly pertinent research, **the stipulations for key habitats outlined in the preferred alternative may be sufficient.** However, as research results become available, there may be increased support for establishing sage-grouse habitat as exclusion areas for commercial renewable energy developments**.**

<u>Fire</u>

Summary of DEIS for Fire

Prescribed fire is maintained as a management option for treatment of sagebrush habitats receiving less than 12 inches of annual precipitation in both alternatives—but both specifically state that fire is to be considered in these xeric habitats only as a means to disrupt fuel continuity for protection of critical areas from wildfire.

Analysis of Fire

The Sage and Columbian Sharp-tailed Grouse Technical Committee (2009) suggest that the scientific evidence supporting the use of prescribed fire for sage-grouse conservation is scant while considerable information documenting negative effects of fire on sage-grouse exists; the authors recommend avoiding the use of prescribed fire in xeric sagebrush habitats. Fischer et al. (1996) reported that the abundance and biomass of ants was reduced the second and third years post-treatment; Nelle et al. (2000) reported a significant increase in ant and beetle abundance 1 year post-treatment, but abundance levels had returned to untreated level within 3 to 5 years; and Slater (2003) reported no difference in abundance or biomass between treated and untreated sites. These results suggest treatments may have limited utility as a tool for sage-grouse brood-rearing habitat management. Slater (2003) reported no difference in nest success probabilities within and outside burn boundaries (35% vs. 20% respectively); but note that overall nest success in his study (24%) was very low suggesting potential impacts to nest success at spatial scales larger than actual treatments. Nelle et al. (2000) reported that prescribed fire negatively affected habitat conditions for sage-grouse nesting and brood rearing up to 15 years post-burn. Beck et al. (2009), after investigating the impact to wintering, nesting, and early brood habitat 14 years post-burn, concluded managers should not consider prescribed fire in xeric sagebrush habitats.

Recommendation for Fire

- **Do not include prescribed fire as a tool for treatments meant to improve habitat conditions for sage-grouse in areas where fire is not being used to specifically target**

range issues (e.g., cheatgrass or wildfire). This needs to be explicitly stated in the preferred alternative as is recommended in the NTT report.

Buffalo (WY) Draft RMP/EIS

General Observation

This was one of the only DEISs we reviewed that incorporated—in Alternative B as described in the *Fluid Minerals Leased* section below—language restricting surface disturbance activities within given distances of leks and seasonal habitats regardless of habitat suitability. The other DEISs incorporating this approach include Oregon and Utah, which incorporated a 1 mile NSO around leks in priority habitats regardless of habitat designation within that 1 mile buffer. This approach is supported by literature, and recommended for inclusion in the preferred alternative.

Shrubland Vegetation

Summary of DEIS for Shrubland Vegetation

Prescribed fire is maintained as a management option for treatment of sagebrush habitats in order "to maintain, restore, and enhance the health and diversity of plant communities" in both the preferred alternative and Alternative B—the alternative in the DEIS most closely aligned with the recommendations forwarded in the NTT report.

Analysis of Shrubland Vegetation

The Sage and Columbian Sharp-tailed Grouse Technical Committee (2009) suggest that the scientific evidence supporting the use of prescribed fire for sage-grouse conservation is scant while considerable information documenting negative effects of fire on sage-grouse exists. The authors recommend avoiding the use of prescribed fire in xeric sagebrush habitats. Fischer et al. (1996) reported that the abundance and biomass of ants was reduced the second and third years after treatment. Nelle et al. (2000) reported a significant increase in ant and beetle abundance 1 year post-treatment, but abundance levels had returned to untreated level within 3 to 5 years. Slater (2003) reported no difference in abundance or biomass between treated and untreated sites. These results suggest treatments may have limited utility as a tool for sage-grouse brood-rearing habitat management. Slater (2003) reported no difference in nest success probabilities within and outside burn boundaries (35% vs. 20% respectively); but note that overall nest success in his study (24%) was very low, suggesting potential impacts to nest success at spatial scales larger than actual treatments. Nelle et al. (2000) reported that prescribed fire negatively affected habitat conditions for sage-grouse nesting and brood rearing up to 15 years post-burn. Beck et al. (2009), after investigating the impact to wintering, nesting, and early brood habitat 14 years post-burn, concluded managers should not consider prescribed fire in xeric sagebrush habitats.

Recommendation for Shrubland Vegetation

- **Do not include prescribed fire as a tool for treatments meant to improve habitat conditions for sage-grouse in xeric areas where fire is not being used to specifically target range issues (e.g., cheatgrass or wildfire).** This needs to be explicitly stated in the preferred alternative as recommended in the NTT report.

Minerals

Summary of DEIS for Minerals—Unleased

The preferred alternative allows leasing of core sage-grouse areas for minerals (fluid, solid, non-energy leasable, etc.) development. Minimum lease size is 640 contiguous acres (1 square mile)—this is assumed to be a technique to facilitate the co-location of infrastructure as it is similar to the potential effects of unitization (see below). This differs from Alternative B—the alternative in the DEIS most closely aligned with the recommendations forwarded in the NTT report—in that habitats within 4 miles of the perimeter of leks and winter concentration areas are closed to fluid mineral leasing. Alternative B also closes core areas to leasing of solid minerals, non-energy leasable minerals, and mineral material sales. Under the preferred alternativem development of leases in core areas, are subject to NSO and CSU stipulations described under Fluid Minerals Leased section below. Core sage-grouse areas in Wyoming were initially delineated by buffering leks and lek complexes by 4 miles and generating polygons of those merged buffers that included large proportions of males based on 2005-07 lek counts (see Doherty et al. 2011); these initial polygons were then refined based on local knowledge and negotiations within a state-led commission.

Unitization provides for the exploration, development, and operation of a geologically defined area by a single operator making phased and/or clustered development more tenable. Unitization may benefit sage-grouse by resulting in the co-location or clustering of infrastructure of energy development. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al. (2007) found that gas development within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities; gas development in this study was measured as the proportion of area around a lek within 350 m of gas field infrastructure—in other words the proportion of a 0.8-km-radius area around a lek within 350 m of infrastructure.

Summary of DEIS for Minerals—Leased

The preferred alternative establishes a 0.6-mile NSO around leks in core areas. Development is subject to direction established by the state of Wyoming: within core and connectivity areas, allow no more than 1 disturbance and no more than 5% total surface disturbance per 640 acres on average within an area delineated by a 4-mile buffer of occupied leks that are located within 4 miles of a proposed project area (Disturbance Density Calculation Tool (DDCT) analysis area). Seasonal timing restrictions are established under the preferred alternative for areas within 4 miles of leks restricted to core or connectivity areas, and within winter concentration areas. In general, for habitats outside core or connectivity areas, the preferred alternative establishes a 0.25-mile CSU around leks, and seasonal timing restrictions within 2 miles of leks and within winter concentration areas. Alternative B establishes a 4-mile NSO buffer around leks and winter concentration areas regardless of habitat suitability, seasonal timing restrictions with 4 miles of leks and winter concentration areas, and seasonal timing restrictions within nesting, early brood-rearing and winter habitats greater than 4 miles from a lek or winter concentration area. No more than 1 disturbance and no more than 3% total surface disturbance per 640 acres on average within a DDCT analysis area regardless of habitat designation (i.e., not restricted to core or connectivity areas) is allowable under Alternative B.

Analysis of Minerals—Leased and Unleased
Research directly relevant to the efficacy of 0.6-mile NSO buffer is not available. However, leks that had at least 1 well pad within 0.4 km (0.25 miles) had 35 to 92% fewer sage-grouse compared with leks with no well pads within this radii (Harju et al. 2010). Walker et al. (2007) reported that implementing a 0.4-km NSO given full field development within the remainder of a 0.8-km or 3.2-km-radius area would result in lek persistence probabilities of 5% and 24%, respectively.

The potential indirect effects of infrastructure on sage-grouse were not addressed by the preferred alternative. Several authors have reported a "distance-effect" associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts to lekking sage-grouse of well pads located at shorter distances to leks were more consistently observed across energy fields compared with well pads at longer distances, with a consistent pattern whereby the presence of well pads within smaller radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared with leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development to the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species. Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

There is a substantial amount of research suggesting that reducing infrastructure densities around leks will benefit sage-grouse. However, no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Harju et al. (2010) reported that common well pad densities of 4 and 8 pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively.

Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below 1 pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding 1 well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (8 pads/section).

Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the “developed” covariate examined included urban and suburban areas, and interstate and state highways as classified by Landfire (2006) and was quantified within 1-km grid cells. Therefore, the results may not be comparable to how the stipulations in the DEIS are forwarded.

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse during the winter avoiding the infrastructure of a gas field during the day, but not at night. This suggests that avoidance was of human activity rather than the infrastructure itself. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period. Traffic levels were not measured but increased levels were inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls; the authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig. These studies would suggest timing restrictions may be effective if human activity around infrastructure in or near seasonal ranges is eliminated or minimized.

Recommendation for Fluid Minerals

- **Institute the approach to limiting surface disturbance outlined in Alternative B** because the preferred alternative does not address a distance effect of infrastructure through the siting of infrastructure**.**
- **Include all areas, regardless of habitat designation, within 2 to 4 km of a lek NSO for lower activity sites (e.g., producing well pads) and all areas within 6 to 6.4 km of a lek NSO for higher activity sites (e.g., drilling rigs).**
- **Restrict fluid mineral development in all areas, regardless of habitat designation, within 2 km of winter range and within 1 km of nesting habitats.** As pointed out in the general comments above, it is worth noting that the approach of addressing indirect distance effects presented in Alternative B is unique to this DEIS and is supported; however, the NSO distances established under this alternative are not supported by literature except for high activity sites near leks.
- **Minimize human activity at infrastructure placed within seasonally protected areas.** Although seasonal timing restrictions are stipulated in the preferred al**t**ernative, recommendations forwarded in the literature as well as the NTT report suggest seasonal timing restrictions are ineffective. Minimization of human activity at infrastructure placed within seasonally protected area**s** may represent a management alternative to enforcing an NSO. For example, Appendix D (*Best Management Practices*) lists the following as RDFs for fluid mineral development in priority habitats: "establish trip restrictions or minimization through use of telemetry and remote well control" and "place liquid gathering facilities outside of priority areas" as well as the following for development in general habitats: "use remote monitoring techniques for production facilities and develop a plan to reduce the frequency of vehicle use"; requiring these practices when developing fluid minerals in sage-grouse habitats could reduce human activity levels in these areas.

<u>**Energy Development: Roads**</u>

Summary of DEIS for Energy Development: Roads

New high-use haul roads (used to transport products or waste) are to be placed >1.9 miles from leks, and low-use roads (used for site access) >0.6 miles from leks in the preferred alternative. The preferred alternative does not establish motorized vehicle restrictions. In contrast, Alternative B prohibits the construction of new roads within 4 miles of sage-grouse leks and winter concentration areas, and closes to motor vehicles areas within habitat of special status wildlife species.

Analysis of Energy Development: Roads

Sage-grouse avoidance of high-activity roads is well documented. Connelly et al. (2004) found that no leks occurred within 2 km of interstate 80, there were fewer leks within 7.5 km than within 15 km of the interstate, and there were higher rates of decline in lek counts between 1970 and 2003 on leks located within compared to beyond 7.5 km of the interstate. Knick et al. (2013) reported that high habitat suitability was associated with <1.0 km/km^2 of secondary roads, 0.05 km/km^2 of highways, and 0.01 km/km^2 of interstate highways within 5-km-radius areas. LeBeau (2012) found that sage-grouse avoided nesting and summering near major roads (e.g., paved secondary highways). Tack (2009) found negative relationships with more roads around leks at all levels of lek attendance, but impacts were greatest for larger leks (>25 males); the probability of occurrence of a large lek was 50% with road densities of approximately 25 km of road within 3.2 km of a lek. Dzialak et al. (2012) documented sage-grouse during the winter avoiding haul roads associated with natural gas development. In contrast results from some of the smaller road categories, Johnson et al. (2011) found negative trends with distance to interstate highway—although few leks occurred near interstates; relatively consistent slight negative trends with distance to highways; and no relationship between distance to secondary roads and lek trends. Road densities within a 5-km radius of leks suggested similar relationships by road category (Johnson et al. 2011).

As noted above, restrictions on the volume of vehicle traffic on roads in sage-grouse habitats as a means of reducing the impacts of roads to sage-grouse are supported management actions. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks<2 km from the road over a 5-year period. Traffic speed was not measured but the potential for increased speed was inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes and that vehicle activity on roads within 3 km of leks during the time of day sage-grouse were present on leks influenced the number of males on leks more negatively than leks where roads within 3 km had no vehicle activity during the strutting period. Lyon and Anderson (2003) reported that traffic disturbance (1 to 12 vehicles/day) within 3 km of leks during the breeding season reduced nest-initiation rates and increased distances moved from leks during nest site selection of female sage-grouse breeding on those leks. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig.

Recommendation for Energy Development: Roads

- **Institute the 1.9-mile avoidance distance for high volume roads, as presented in the preferred alternative and supported by the literature**.
- **Include seasonal closure of roads, as presented by Alternative B**. As mentioned above, minimization of human activity within sage-grouse habitats may limit impacts of infrastructure within these habitats.

<u>Rights-of-Way (ROWs)</u>

Summary of the DEIS for ROWs

Sage-grouse core areas are managed as Rights-of-Way (ROW) avoidance areas with a 0.6-mile NSO area around leks under the preferred alternative. In general sage-grouse habitats, overhead power lines need to be located at least 0.5 miles from breeding and nesting areas. Anti-perching devices are required on overhead power lines in sage-grouse core and general habitats. Alternative B establishes core areas as ROW exclusion areas.

Analysis of ROWs

Research directly relevant to the efficacy of 0.6-mile NSO buffer around leks is not available. However, leks that had at least 1 well pad within 0.4 km (0.25 miles) had 35 to 92% fewer sage-grouse compared to leks with no well pads within this radii (Harju et al. 2010). Walker et al. (2007) reported that implementing a 0.4-km NSO given full field development within the remainder of a 0.8-km- or 3.2-km-radius area would result in lek persistence probabilities of 5% and 24%, respectively.

Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggests that these structures may negatively influence sage-grouse habitat selection and survival. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.20 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission line increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors as gas wells. See also discussion under rights-of-way below. Other often cited studies that may provide evidence of impacts of power lines on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data. Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within 2 years, but this study had a sample size of one . Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only 2 juvenile grouse were killed by running into power lines.

Slater and Smith (2008) reported that perch deterrents reduced the occurrence of corvids and raptors relative to a control (non-deterred) line, but that perching was not entirely prevented. Lammers and Collopy (2007) found that perch deterrents reduced the probability of a raptor or corvid perching on a power pole and reduced the duration of perching, but they also reported that perching was not entirely prevented by perch deterrents. In contrast, Prather and Messmer (2010) found that perch deterrents were ineffective at reducing the number of perch-events of raptors and corvids.

Recommendation for ROWs

- **Consider the option of changing sage-grouse habitats from avoidance to exclusion areas in the DEIS.** Because of the inconclusive nature of current research, **the stipulations for key habitat areas outlined in the preferred alternative may be sufficient.** However, as research results become available, there may be increased support for establishing all sage-grouse habitat as exclusion areas for ROWs as stipulated under Alternative B

- **Avoid substituting anti-perching devices for burial or elimination of power lines to maintain key habitats** because perch-deterrents reduce but do not eliminate perching on power poles by raptors and corvids.

<u>Livestock Grazing</u>

Summary of DEIS for Livestock Grazing

The preferred alternative adopts grazing permit monitoring stipulations that generally rely upon rangeland health standards. Alternative B does not differ from the preferred alternative. It is worth noting that the preferred alternative mentions that ecological site descriptions will be used to manage vegetation composition, diversity and structure to meet "sage-grouse habitat management objectives."

Analysis of Livestock Grazing

Management of sagebrush habitats for sage-grouse in the context of state-and-transition theories (e.g., ecological site capabilities) is a function of both long-term management to promote desirable plant communities and species composition and growth, and annual management of the standing crop to provide cover for sage-grouse (Cagney et al. 2010). Managing solely for towards the capabilities of an ecological site addresses some but not all of the sagebrush habitat management issues. The potential exists to manage a site for long-term stability within the reference community but fail to achieve sage-grouse habitat objectives. For example, late season and winter livestock use of a site may provide for long-term resilience of the site in the reference state but fail to provide sufficient hiding cover for sage-grouse. Sage-grouse initiate nesting prior to the production of the current year's standing crop of herbaceous vegetation, and as such, residual grasses left from the previous year represent the initial cover available for nesting sage-grouse (Cagney et al. 2010).

Recommendation for Livestock Grazing

- **Include sage-grouse specific metrics and indicators when assessing livestock grazing management needs** as recommended in the NTT report.

Lander Final RMP/EIS

The BLM's Lander planning area is a somewhat unique circumstance relative to the other 14 regional sage-grouse plans. BLM was much of the way through its Lander planning effort when the regional sage-grouse efforts were initiated. As a result, BLM directly incorporated its sage-grouse management prescriptions into that planning effort. The draft plan was released in September 2011, and the final EIS / proposed RMP was issued in February 2013. BLM has not issued a Record of Decision for the Lander RMP.

Many of the same observations about BLM's proposed management in its regional sage-grouse plans hold true in Lander as well. Therefore, we incorporate by reference the comments from the other plans as they relate to Lander, particularly those from surrounding Wyoming plans. As examples, the proposed action does not prohibit oil, gas, and geothermal development within 4 miles of sage grouse leks in priority habitat, address the minimization of human activity near leks, or prohibit surface occupancy in or adjacent to priority winter habitat. BLM can and should significantly strengthen land-use management prescriptions for Lander in its pending Record of Decision congruent with our other comments.

9-Plan (WY) Greater Sage-Grouse Draft RMP/EIS

General Observation

The Regional Mitigation Strategy (Appendix B) establishes the implementation of "a structure for determining appropriate mitigation, including impact (debit) and benefit (credit) calculation methods, mitigation ratios, mitigation "currency" (i.e., numbers of birds, acres, etc.), location, and performance standards options by considering local and regional mitigation options." Metrics associated with a tool such as this need to be developed in a scientifically rigorous manner; monitoring, iterative evaluation and adaptation are critical to the success of this sort of approach and actual offset needs to occur under this sort of program (e.g., conservation easements without habitat improvement are not to be considered for "credit").

The DEIS's "Population Objective"

Summary

A statewide "adaptive management" plan is to be developed outlining triggers, monitoring requirements, and appropriate mitigation, restoration and reclamation actions required to maintain a population objective established in the DEIS of at least 67% of the 2005-09 sage-grouse core area population in the state of Wyoming.

Analysis

Although the premise of a statewide adaptive management plan including proactive habitat management actions is sound, the enhancement or restoration of sagebrush-habitats is not a trivial task. There is tremendous uncertainty as to the vegetative and sage-grouse population outcomes of habitat manipulations (Johnson and Holloran 2010). Managers often justify habitat manipulations with potential long-term benefits, but the long-term effects to habitats and consequences to sage-grouse of such manipulations are largely unknown. Extreme caution and discretion should be employed when proposing habitat treatments, especially on drier sites, sites where cheatgrass may invade, and sites with limited potential to produce sagebrush (e.g., the interface between the Wyoming Basin and the Great Plains; Cagney et al. 2010). This is not to say efforts should not be initiated to address habitat degradation—as habitat degradation is a significant causal factor in sage-grouse declines (see Connelly et al. 2004). A conservative approach to proactive habitat manipulations is warranted as we do not have all, or even many of the answers, when it comes to improving sagebrush habitat conditions for sage-grouse. Although mitigation plans should be developed at landscape spatial scales, development at these scales does not necessitate that treatments be implemented across these scales. A small-scale, case-by-case treatment regime conducted over the long term should be implemented. The plan needs to be generated rigorously from an analysis of all available information, and should set in motion a process whereby data from implemented actions are used to inform future actions in an iterative cycle where management actions are continually being evaluated and modified based on lessons learned through the evaluation of past management actions. The iterative evaluation is extremely important given the uncertainty surrounding sagebrush habitat management, and needs to be the central theme of implementation for any adaptive management plan.

<u>Fluid Minerals</u>

Summary of DEIS for Unleased Fluid Minerals

The preferred alternative allows leasing of core sage-grouse areas for fluid minerals development. Minimum lease size is 640 contiguous acres (1 square mile)—this is assumed to be a technique to facilitate the co-location of infrastructure as it is similar to the potential effects of unitization. This differs from Alternative B—the alternative in the DEIS most closely aligned with the recommendations forwarded in the NTT report—in that core sage-grouse habitats would be closed to fluid mineral leasing under Alternative B. Development of leases in core areas under the preferred alternative are subject to NSO and CSU stipulations described under Fluid Minerals Leased section below. Core sage-grouse areas in WY were initially delineated by buffering leks and lek complexes by 4 miles and generating polygons of those merged buffers that included large proportions of males based on 2005-07 lek counts (see Doherty et al. 2011); these initial polygons were then refined based on local knowledge and negotiations by a state-led commission. Recommendations for *Fluid Minerals-Unleased* are included below *Fluid Minerals Leased*.

Summary of DEIS for Leased Fluid Minerals

The preferred alternative establishes a 0.6-mile NSO around leks in core areas. Development is subject to direction established by the state of Wyoming: within core and connectivity areas, allow no more than 1 disturbance and no more than 5% total surface disturbance per 640 acres on average within an area delineated by a 4-mile buffer of occupied leks that are located within 4 miles of a proposed project area (Disturbance Density Calculation Tool (DDCT) analysis area). Seasonal timing restrictions are established under the preferred alternative for all core areas during the breeding, nesting and brood-rearing seasons, and within winter concentration areas. In general habitats outside of core or connectivity areas, the preferred alternative establishes a 0.25-mile CSU around leks, and seasonal timing restrictions within 2 miles of leks and within winter concentration areas. Alternative B establishes an NSO in core habitats and winter concentration areas.

Analysis of Fluid Minerals

Research directly relevant to the efficacy of 0.6-mile NSO buffer is not available. However, leks that had at least 1 well pad within 0.4 km (0.25 miles) had 35 to 92% fewer sage-grouse compared to leks with no well pads within this radii (Harju et al. 2010). Walker et al. (2007) reported that implementing a 0.4-km NSO given full field development within the remainder of a 0.8-km- or 3.2-km-radius area would result in lek persistence probabilities of 5% and 24%, respectively.

Unitization provides for the exploration, development, and operation of a geologically defined area by a single operator making phased and/or clustered development more tenable. Unitization may benefit sage-grouse by resulting in the co-location or clustering of infrastructure of energy development. Holloran (2005) reported that lek counts declined to a greater degree on leks located relatively centrally within a developing gas field (i.e., producing wells occupying ≥3 directions around leks) compared to leks not surrounded by infrastructure. Walker et al. (2007) found that gas development within 0.8 or 3.2 km of a lek negatively influenced lek persistence probabilities; gas development in this study was measured as the proportion of area around a lek within 350 m of gas field infrastructure—in other words the proportion of a 0.8-km-radius area around a lek within 350 m of infrastructure.

The potential indirect effects of infrastructure on sage-grouse were not addressed by the preferred alternative. Several authors have reported a "distance-effect" associated with the infrastructure of energy fields whereby sage-grouse on leks are negatively influenced to a greater extent if infrastructure is placed near the lek, with the response diminishing as distances from lek to infrastructure increase (Manier et al. 2013). Additionally, the distance-effect of infrastructure with higher levels of human activity may be larger than that of infrastructure with lower levels of activity. Harju et al. (2010) reported that impacts to lekking sage-grouse of well pads located at shorter distances to leks were more consistently observed across energy fields compared to well pads at longer distances, with a pattern whereby the presence of well pads within smaller radii buffers (<1.6-2 km) around leks in extensively developed areas was associated with 35-76% fewer sage-grouse males on leks compared to leks with no well pads within these radii. Walker et al. (2007) found a strong negative effect of infrastructure within 0.8 and 3.2 km of leks on lek persistence, with lesser impacts to lek persistent probabilities apparent at 6.4 km. Holloran (2005) reported that impacts of development to the number of males occupying leks were greatest when infrastructure was located near the lek, but that impacts were discernible to 3 km for lower activity sites (producing well pads) and 6 km for higher activity sites (drilling rigs). Johnson et al. (2011) reported negative lek trends for leks within approximately 4 km of a producing well pad across the range of the species. Additionally, distance effects of infrastructure have been noted for other seasonal periods. Carpenter et al. (2010) found that sage-grouse avoided habitats within 1.9 km of infrastructure during the winter. Holloran et al. (2010) reported that yearling females avoided nesting within 950 m of well pads; annual survival of sage-grouse chicks reared near gas field infrastructure was lower than those reared away from infrastructure; and that the probability of male chicks reared near infrastructure establishing a breeding territory as a yearling was half that of male chicks reared away from infrastructure. Dzialak et al. (2011) reported that the closer a nest was to a natural gas well (that existed or had been installed in the previous year), the more likely it was to fail.

Substantial amounts of research suggest that reducing infrastructure densities around leks will benefit sage-grouse. However, no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized. Harju et al. (2010) reported that common well pad densities of 4 and 8 pads/section within 8.5 km of leks were associated with lek count declines ranging from 13-74% and 77-79%, respectively. Doherty et al. (2010) reported that impacts to leks were indiscernible at well pad densities at or below 1 pad/section within 3.2 km of leks, but that lek loss and declines in numbers of males on leks increased at greater densities. Holloran (2005) reported that well densities exceeding 1 well/section within 3 km of leks negatively influenced male lek attendance. Hess and Beck (2012) reported 0% probability of lek occurrence in areas with well pad densities exceeding 6.5 pads/section within 1 km. Tack (2009) reported that larger leks (>25 males) did not occur in areas where well pad densities exceeded 2.5 pads/section within 12.3 km of a lek. Johnson et al. (2011) found a generally negative trend in lek counts with increasing numbers of producing wells within 5 and 18 km of leks. Kirol (2012) reported that females avoided nesting and rearing broods in areas with increased numbers of visible wells within a 1-km^2 area. Aldridge and Boyce (2007) reported that chick survival decreased with increasing numbers of visible wells within 1 km of brood-rearing locations. Doherty et al. (2008) found that sage-grouse were 1.3 times more likely to occupy suitable winter habitats with no gas field infrastructure within a 4-km^2 area compared to areas with 12.3 pads (8 pads/section).

Kirol (2012) reported that chick survival decreased when the proportion of a 1-km^2 area disturbed by gas development exceeded 4% and that females avoided late brooding sites when the proportion of a 5-km^2 area disturbed by gas development exceeded 8%. Knick et al. (2013) reported that 99% of active leks were in landscapes <3% developed within 5 km. It is worth noting that the "developed" covariate examined included urban and suburban areas, and interstate and state highways as classified by Landfire (2006) and was quantified within 1-km grid cells. Therefore, results may not be comparable how the stipulations in the DEIS are forwarded.

Researchers have noted that timing restrictions on construction and drilling during the breeding season will not prevent impacts of infrastructure at other times of the year or during other phases of development (e.g., production phases) and may not be sufficient (Walker et al. 2007, Doherty et al. 2008). However, Dzialak et al. (2012) documented sage-grouse during the winter avoiding the infrastructure of a gas field during the day, but not at night. This suggests that avoidance was of human activity rather than the infrastructure itself. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period. Traffic levels were not measured but increased levels were inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig. These studies would suggest timing restrictions may be effective if human activity around infrastructure in or near seasonal ranges is eliminated or minimized.

Fluid Minerals Recommendation

- **Institute stipulations in Alternative B, as they are supported by scientific knowledge of fluid mineral development impacts to sage-grouse.** The approach to limiting surface disturbance outlined in the preferred alternative does not address a distance effect of infrastructure through the siting of infrastructure. **Scientific literature suggests that, regardless of habitat designation, no surface occupancy should occur within 2 to 4 km of a lek for lower activity sites (e.g., producing well pads) and all areas within 6 to 6.4 km of a lek NSO for higher activity sites (e.g., drilling rigs). The literature also suggests restricting fluid mineral development in all areas, regardless of habitat designation,**

within 2 km of winter range and within 1 km of nesting habitats. Given the foundation of the technique used to establish core areas (i.e., a 4-mile buffer around leks), the NSO stipulation in core habitats forwarded under Alternative B is supported to minimize the impact to leks of high activity sites. Additionally, if the goal of the 0.6-mile NSO in core habitats established under the preferred alternative is to minimize negative impacts of energy development on sage-grouse populations (rather than, for example, maintaining lekking habitat integrity), current research supports the NSO buffers recommended in bold font above; the 0.6-mile NSO should be sufficient to protect the habitats used by male sage-grouse during the breeding season, but will not eliminate indirect effects of energy development.

- **Minimize human activity at infrastructure places within seasonally protected areas.** Although seasonal timing restrictions are stipulated in the preferred alternative, recommendations forwarded in the literature as well as the NTT report suggest seasonal timing restrictions are ineffective. Minimization of human activity at infrastructure placed within seasonally protected areas may represent a management alternative to enforcing an NSO. For example, Appendix B (*Required Design Features*) lists the following as RDFs for fluid mineral development: “establish trip restrictions or minimization through use of telemetry and remote well control” and “place liquid gathering facilities outside of priority areas”; requiring these practices when developing fluid minerals in priority areas could reduce human activity levels in these areas.

<u>**Solid Leasable Minerals and Salable Minerals**</u>

The preferred alternative allows for the leasing and development of leases in sage-grouse core areas. Alternative B closes sage-grouse core areas to these activities.

Due to limited scientific information regarding solid leasable and salable mineral development impact on sage-grouse, we refer to the information and recommendations forwarded under Fluid Minerals, which provide general insight.

<u>**Livestock Grazing**</u>

Summary of DEIS for Livestock Grazing

The preferred alternative adopts permit monitoring stipulations established by regional RMPs that generally rely upon rangeland health standards. Alternative B includes indicators and measures of vegetative attributes specific to the habitat needs of sage-grouse.

Analysis of Livestock Grazing

Management of sagebrush habitats for sage-grouse in the context of state-and-transition theories (e.g., ecological site capabilities) is a function of both long-term management to promote desirable plant communities and species composition and growth, and annual management of the standing crop to provide cover for sage-grouse (Cagney et al. 2010). Managing solely for towards the capabilities of an ecological site addresses some but not all of the sagebrush habitat management issues. The potential exists to manage a site for long-term stability within the reference community but fail to achieve sage-grouse habitat objectives. For example, late season and winter livestock use of a site may provide for long-term resilience of the site in the reference state but fail to provide sufficient hiding cover for sage-grouse. Sage-grouse initiate nesting prior to the production of the current year's standing crop of herbaceous vegetation, and as such, residual grasses left from the previous year represent the initial cover available for nesting sage-grouse (Cagney et al. 2010).

Recommendation for Livestock Grazing

- **Adopt stipulations in Alternative B, as they are supported by scientific knowledge of livestock impacts to sage-grouse.** Sage-grouse specific metrics and indicators are necessary to ensure sufficient standing crop and cover for sage-grouse.

Infrastructure

Summary of DEIS for Infrastructure

Surface disturbance is limited to 5% per section in the preferred alternative as described for fluid minerals above. Surface disturbance is limited to 3% of total priority habitats in Alternative B.

As noted above, there is a substantial amount of research suggesting that reducing infrastructure densities around leks will benefit sage-grouse. However no research exists establishing a consistent surface disturbance threshold whereby impacts to sage-grouse are minimized.

Recommendation for Infrastructure

As noted above, management actions specific to the distance effect of infrastructure is not addressed in the preferred alternative; literature suggests that this effect needs to be addressed.

Mitigation

Alternative B establishes that "additional, effective mitigation" would be implemented in core habitats when necessary. No similar wording is used in the preferred alternative. Although discussed at length above, it is worth reiterating that even though the premise of "effective mitigation" is well-meaning, tremendous uncertainty exists as to the vegetative and sage-grouse population outcomes of habitat treatments.

Rights-of-way

Summary of DEIS for Rights-of-Way

Sage-grouse core areas are managed as Right-of-Way (ROW) avoidance areas under the preferred alternative. Anti-perching devices are required on overhead power lines in sage-grouse core and general habitats. Alternative B establishes core areas as ROW exclusion areas.

Analysis of Rights-of Way

Research investigating the impacts of transmission and power lines on sage-grouse is not conclusive, but suggests that these structures may negatively influence sage-grouse habitat selection and survival. Knick et al. (2013) reported that leks were absent from 5-km-radius areas where transmission line and major power line densities exceeded 0.20 km/km^2. LeBeau (2012) reported that sage-grouse avoided habitats within 4.7 km of transmission lines during brood-rearing, and that the probability of nest success and probability of female survival increased as distance to transmission line increased. It is worth noting that the author found that brood-rearing and nesting sage-grouse selected habitats nearer to transmission lines in the control study area. Walker et al. (2007) reported that the probability of lek persistence decreased with proximity to power lines and with increasing proportion of power lines within a 6.4 km window around leks. Yet, distances to power line and power line densities as covariates were highly correlated with other gas development infrastructure covariates examined on the study site, and were not as good predictors as gas wells. See also discussion under rights-of-way below. Other often cited studies that may provide evidence of impacts of power lines on sage-grouse include: Braun (1998) reported that sage-grouse avoided habitats within 600 m of transmission lines, but results were based on unpublished pellet survey data. Ellis (1985) reported that the erection of a transmission line within 200 m of an active sage-grouse lek and located between the lek and male breeding season day use areas resulted in a 72% decline in the mean number of males and an alteration in daily dispersal patterns during the breeding season within 2 years, but this study had a sample size of one. Beck et al. (2006) reported that collisions with power lines accounted for 33% of juvenile sage-grouse winter mortality, but only 2 juvenile grouse were killed by running into power lines.

Slater and Smith (2008) reported that perch deterrents reduced the occurrence of corvids and raptors relative to a control (non-deterred) line, but that perching was not entirely prevented. Lammers and Collopy (2007) found that perch deterrents reduced the probability of a raptor or corvid perching on a power pole and reduced the duration of perching, but they also reported that perching was not entirely prevented by perch deterrents. In contrast, Prather and Messmer (2010) found that perch deterrents were ineffective at reducing the number of perch-events of raptors and corvids.

Recommendation for Rights-of-Way

- **Consider the option of changing core areas from avoidance to exclusion areas.** Because of the inconclusive nature of current research, **the stipulations for core areas outlined in the preferred alternative may be sufficient.** However, as research results become available, there may be increased support for establishing all sage-grouse habitat as exclusion areas for ROWs.
- **Avoid substituting anti-perching devices for burial or elimination of power lines to maintain core habitats** because perch-deterrents reduce but do not eliminate perching on power poles by raptors and corvids. **Alternative B provides increased certainty for sage-grouse and will ensure the integrity of core habitats**.

<u>**Travel Management**</u>

Summary of DEIS for Travel Management

New primary and secondary roads are to be placed >1.9 miles from leks, and tertiary roads >0.6 miles from leks in core habitat areas in the preferred alternative, otherwise management defers to a future planning process. Alternative B refers Travel Management issues to a future planning process.

Analysis of Travel Management

Restrictions on the volume of vehicle traffic on roads in sage-grouse habitats as a means of reducing the impacts of roads to sage-grouse are supported management actions. Remington and Braun (1991) reported that the upgrade of a haul road accessing a coal mine was correlated with a 94% decline in the number of sage-grouse on leks <2 km from the road over a 5-year period. Traffic speed was not measured but the potential for increased speed was inferred from upgraded road surface. Holloran (2005) reported that declines in lek counts on leks within 3 km of roads were positively correlated with increased traffic volumes and that vehicle activity on roads within 3 km of leks during the time of day sage-grouse were present on leks influenced the number of males on leks more negatively than leks where roads within 3 km had no vehicle activity during the strutting period. Lyon and Anderson (2003) reported that traffic disturbance (1 to 12 vehicles/day) within 3 km of leks during the breeding season reduced nest-initiation rates and increased distances moved from leks during nest site selection of female sage-grouse breeding on those leks. Blickley et al. (2012) report that peak male attendance (i.e., abundance) at leks experimentally treated with noise recorded at roads in a natural gas field decreased 73% relative to paired controls. The authors found that the intermittent nature of noise from roads impacted male sage-grouse to a greater degree than more constant noise as that from a drilling rig.

Recommendation for Travel Management

- **Consider seasonal closures of road within sage-grouse habitats. The preferred alternative, containing a 1.9-mile avoidance distance for high volume roads is supported by scientific literature**. As mentioned above regarding timing restrictions, minimization of human activity within sage-grouse habitats may limit impacts of infrastructure within these habitats and therefore seasonal closures of roads within sage-grouse habitats should be considered as suggested in the NTT report.

<u>Renewable Energy</u>

Summary of DEIS for Renewable Energy

The preferred alternative does not limit meteorological (MET) towers—used to acquire information necessary to evaluate wind energy production potential of a location—in core habitats. In contrast, MET towers are prohibited in core areas under Alternative B.

Analysis of Renewable Energy

Research directly relevant to the impact of MET towers to sage-grouse is unavailable; but research on communication towers may be relevant these structures. Despite low numbers of communication towers across the sagebrush biome, sage-grouse lek trends across the range of the species generally increased with distance to nearest communication tower and generally decreased with increasing numbers of towers within 5 km and 18 km of leks (Johnson et al. 2011). The authors surmised that the response of sage-grouse to communication towers may be correlative with human development in general as these types of towers tend to be concentrated along major roadways and near urban centers; however, with the increase in these types of structures throughout the sagebrush biome (e.g., meteorological towers at proposed wind developments), it is worth considering the documented effects.

Recommendation for Renewable Energy

- **Include communication towers and similar structures as disturbances under the surface disturbance cap, as supported by the literature.** Stipulations forwarded in Alternative B are not supported in the literature.

Conclusion

The Pew Charitable Trusts appreciates the opportunity to comment on the BLM's 15 regional sage-grouse plans. Our comments are based on the body of peer-reviewed literature that exists for the sage-grouse, as well as the BLM's National Technical Team report. We hope that you will incorporate the science-based recommendations contained herein as part of making the agency's final plans strong, defensible, and lasting. BLM has an unprecedented opportunity to provide a responsible balance between large-scale conservation across nearly 50 million acres of public lands in the interior West and the development that occurs here. The draft plans are a start, but the plans need to be significantly improved and made consistent across planning area boundaries to accomplish the agency's goal of providing sufficient conservation measures to ensure the long-term viability of sage-grouse populations across the BLM domain. We look forward to working with the agency as the plans are advanced from the draft to their final stage.

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