Best Management Practices for Electric Utilities in Sage-Grouse Habitat

DRAFT

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1.0 Executive Summary

The Avian Power Line Interaction Committee (APLIC) is a collaborative of electric utilities, resource agencies, and conservation organizations that addresses a variety of avian/power line interactions including electrocutions, collisions, nests, and avian concerns associated with construction, maintenance, and operation of electric transmission and distribution infrastructure. APLIC's mission is to lead the electric utility industry in protecting avian resources while enhancing reliable energy delivery. Some of APLIC's recent efforts have focused on assessing impacts to sage-grouse and priority sagebrush habitat from electric utility infrastructure.

Wildlife scientists and public land managers have expressed concerns that new and existing electric transmission and distribution structures may be contributing alone or in concert with other stressors, to impact sage-grouse and their habitat. Limited and sometimes conflicting information is available in the literature. Siting guidelines and stipulations for utility infrastructure in sage-grouse areas vary between state and federal agencies, as well as within federal agencies. The effectiveness of these siting guidelines and stipulations such as no-disturbance buffer distances and seasonal construction or maintenance restrictions have not been adequately evaluated.

In response to sage-grouse/power line concerns, uncertainties related to siting and permitting of new lines, and variability in avoidance and minimization guidance, APLIC convened a group of utility and federal and state agency partners to develop best management practices (BMPs) that would aid in addressing these issues and help conserve sage-grouse.

The voluntary BMPs presented and discussed herein are intended to provide consistent and implementable actions that comply with and augment sage-grouse specific conservation measures, recommendations, and requirements contained within federal and state management plans. These BMPs are not intended to replace or conflict with existing agency plans, but rather provide additional detail specific to electric transmission and distribution infrastructure and related actions. The BMPs were categorized under various activities conducted by utilities and also aligned with potential threats identified in the 2013 U.S. Fish and Wildlife Service (USFWS) Conservation Objectives Team (COT) Report. APLIC encourages the use of and reference to these BMPs during permitting and re-permitting of electric facilities in conjunction with state and federal sage-grouse plans. APLIC further encourages utilities that operate in sage-grouse habitat to directly reference or incorporate these BMPs into their internal company procedures.

Utilities and agencies that implement the BMPs contained within this document are encouraged to evaluate their effectiveness and communicate this information to APLIC, resource agencies, and utilities, thereby providing valuable information for future revisions of this document. This document is a "living document" and may be updated or revised as needed to reflect new science, techniques, resources, or regulatory requirements.

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2.1 What is APLIC?

The Avian Power Line Interaction Committee (APLIC) was formed in 1989 as a collaborative effort among electric utilities, resource agencies, and conservation organizations to address whooping crane collisions with power lines. Since its inception, APLIC has expanded to address a variety of avian/power line interactions including electrocutions, collisions, nests, and avian concerns associated with construction, maintenance, and operation of electric transmission and distribution infrastructure.

Current APLIC membership includes electric utilities in the U.S. and Canada, Edison Electric Institute (EEI), Electric Power Research Institute (EPRI), National Rural Electric Cooperative Association (NRECA), Rural Utilities Service (RUS), and the U.S. Fish and Wildlife Service (USFWS). For more information about APLIC and upcoming training workshops, see www.aplic.org. APLIC's mission is to lead the electric utility industry in protecting avian resources while enhancing reliable energy delivery. APLIC works in partnership with utilities, resources agencies and the public to:

- Develop and provide educational resources
- Identify and fund research
- Develop and provide cost-effective management options, and
- Serve as the focal point for avian interaction utility issues

Since the 1970s, APLIC has produced and updated manuals for addressing avian electrocutions and collisions including the most recent publications: *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006* and *Reducing Bird Collisions with Power Lines: The State of the Art in 2012*. In 2005, APLIC and the USFWS jointly released *Avian Protection Plan Guidelines,* which offer a "toolbox" for utilities to address avian issues. In addition, APLIC offers short courses annually that provide an overview of avian/power line issues and solutions, including collisions, electrocutions, nests on utility structures, and construction impacts. APLIC also funds bird/power line research and has sub-groups that address species-specific considerations, such as sage-grouse[1].

APLIC member utilities are committed to constructing, operating, and maintaining their infrastructure to deliver safe and reliable power in ways that avoid and minimize environmental impacts, particularly in regards to birds, and other wildlife, and their habitats.

[1] Throughout this document, the term "sage-grouse" is used to collectively, referring to both greater sage-grouse (*Centrocercus urophasianus*) and Gunnison sage-grouse (*C. minimus*).

3.0 Introduction and Purpose

Increasing demands for electricity and the development of energy projects require construction of new power lines and upgrades of existing infrastructure to transmit electricity from where it is generated, which is often in remote areas, to more populated load centers and/or new customers. Impacts of tall structures[2] such as power lines on sage-grouse in exclusion of other anthropogenic features are not well-studied. However, research has documented that cumulative impacts of anthropogenic development (e.g. residential development and oil and gas facilities) can have significant, negative impacts on sage-grouse populations (Knick et al. 2013, Johnson et al. 2011, Leu and Hanser 2011). Wildlife scientists and public land managers have expressed concerns that new and existing electric transmission and distribution structures may be contributing alone or in concert with other stressors, to impact sage-grouse and their habitat. Conflicting information is available in the literature. For example, in a large-scale modeling analysis, sage-grouse leks (male displaying grounds) were absent from areas where power line densities exceeded 0.20 km/km2 or communication towers densities exceeded 0.08 km/km2 (Knick et al. 2013). In contrast, Johnson et al. (2011) found no effect of power lines on lek trends. Siting guidelines and stipulations for utility infrastructure in sage-grouse areas vary between state and federal agencies, as well as within federal agencies. The effectiveness of these siting guidelines and stipulations such as disturbance buffer distances (disturbance buffers) and seasonal construction or maintenance restrictions have not been adequately evaluated to date (Messmer et al. 2013).

In response to sage-grouse/power line concerns, uncertainties related to siting and permitting new lines and variability in avoidance and minimization guidance, APLIC convened a group of utility and agency partners to develop best management practices (BMPs) that would aid in addressing the issues. Consequently, APLIC and its federal and state agency partners have prepared a suite of BMPs, contained herein, for the purposes of:

- Assisting electric utilities to avoid, minimize, and/or mitigate impacts to sage-grouse and their habitats, that may result from the construction and maintenance of new or existing electrical facilities on federal, state, and private lands. Avoidance includes measures to avoid impacts from the outset through careful spatial or temporal placement of facilities. Where avoidance is not feasible, compensatory mitigation may alleviate any residual adverse impacts. Reclamation would be included with avoidance, minimization, and compensatory mitigation efforts to reclaim vegetation temporarily disturbed during construction activities.
- Providing a clearinghouse document that is specific to electric utility activities, how these activities may impact sage-grouse or their habitats, and BMPs targeted specifically to these activities.

[2] "Tall Structures" may include power lines, communication towers, wind turbines, and other installations, excluding livestock fencing (Messmer et al. 2013).

- Maintaining a "living document" that can be referenced in other documents (e.g. state sage-grouse plans, Bureau of Land Management (BLM) and U.S. Forest Service (USFS) planning documents, utility rights-of-way (ROW) grants, etc.) and would be updated to reflect the best science available.

The BMPs presented and discussed herein are intended to provide consistent and implementable actions that comply with and augment sage-grouse specific conservation measures, recommendations and requirements contained within federal and state management plans. These BMPs are not intended to replace or conflict with existing agency plans, but rather provide additional detail specific to electric transmission and distribution infrastructure and related actions. APLIC encourages the use of and reference to these BMPs during permitting and re-permitting of electric facilities in conjunction with state and federal sage-grouse plans as well as APLIC's other avian protection guidance documents:

- *Avian Protection Plan Guidelines* (APLIC and USFWS 2005).
- *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006 (*APLIC 2006*);*
- *Reducing Bird Collisions with Power Lines: The State of the Art in 2012* (APLIC 2012); and

These sage-grouse BMPs and the above referenced APLIC documents can serve as a "toolbox" from which a utility may select and tailor components applicable to its specific needs. APLIC further encourages utilities that operate in sage-grouse habitat to directly reference or incorporate these BMPs into their internal company procedures, such as utility Avian Protection Plans (APP). In some cases, development of a sage-grouse specific conservation plan, e.g. for a new transmission line may be appropriate.

The layout of this document is two-part:

- Sections 4 through 6 provide background information regarding electric utility construction, operations, and the regulatory framework under which utilities operate. These sections establish the context in which the identified BMPs may be implemented; and
- Sections 7 through 9 present a summary of recommended BMPs for use in siting, permitting, constructing, operating, and maintaining new and existing power lines and associated infrastructure (e.g., access roads) to minimize impacts to sage-grouse and their habitat.

3.1 Document Revisions

This document is a "living document" and may be updated or revised as needed to reflect new science, techniques, resources, or regulatory requirements. APLIC members and agency partners would collaborate on future document updates and revisions. Utilities and agencies that implement the BMPs contained within this document are encouraged to evaluate the BMP effectiveness and communicate this information to APLIC, resource agencies, and utilities thereby providing valuable information for future revisions of this document. BMP implementation and effectiveness will be an ongoing discussion topic within the APLIC sage-grouse working group.

4.0 Background of Sage-grouse/Power Line Efforts

In 2010, the USFWS placed greater sage-grouse on the list of species that are candidates for protection under the Endangered Species Act (ESA) (United States Department of the Interior, 2010; Endangered and threatened wildlife and plants; 12 month findings for petitions to list the greater sage-grouse (*Centrocercus urophasianus; hereafter sage-grouse*) as threatened or endangered, Federal Register 75:13910-13958). There are five criteria utilized for assessing listing decisions:

- Present or threatened destruction, modification, or curtailment of habitat or range
- Overuse for commercial, recreational, scientific or educational purposes
- Disease or predation
- Inadequacy of existing regulatory mechanisms
- Other natural or manmade factors affecting the species continued existence

The USFWS's finding determined that the two primary threats to greater sage-grouse are habitat destruction/modification and lack of sufficient regulatory mechanisms to protect the species. Approximately 60% of the extant habitat for greater sage-grouse occurs on federal lands.

Prior to the USFWS 2010 decision, the Western Association of Fish and Wildlife Agencies (WAFWA) convened a diverse group of stakeholders to identify problems and strategies to conserve sage-grouse. This forum developed the *Greater Sage-grouse Comprehensive Conservation Strategy* (2006) (Strategy), which recognized the need to assess the potential effect that tall structures may have on sage-grouse. The following four goals were identified in Appendix C, pages 29-31, of the Strategy document:

> 1. *Compile and evaluate published research on the effects on sage-grouse due to impacts of existing tall structures*.
>
> 2. *Develop research protocols to conduct new studies to assess impacts of tall structures*.
>
> 3. *Develop scientific and consistent siting and operation and maintenance (O&M) criteria for tall structures in sage-grouse habitat to minimize negative impacts on sage-grouse*.
>
> 4. *Develop BMPs and appropriate mitigation measures to implement for siting and O&M activities associated with tall structures*.

Achieving these goals and implementing the resulting BMPs would provide the USFWS with additional information for consideration in their review of the current status and threat assessment of sage-grouse. APLIC's participating members and other entities recognized the need and value in accomplishing the WAFWA identified goals. Therefore, under the direction and support of WAFWA and its Executive Oversight Committee (EOC), Utah Division of

Wildlife Resources (UDWR), Utah Wildlife in Need (UWIN) and its partners initiated an inclusive, consensus-based process to address and attain the four goals identified in the Strategy document.

In September 2010, with UWIN's publication, *Contemporary Knowledge and Research Needs Regarding the Potential Effects of Tall Structures on Sage-grouse (Centrocercus urophasianus and C. minimus)* [www.utahcbcp.org], **Goal 1** was addressed. The document reported that no peer-reviewed, experimental studies either confirmed or denied the effects of tall structures on sage-grouse and that additional research is required to effectively evaluate/ascertain impacts.

Following the above publication, UWIN hosted a working seminar attended by sage-grouse researchers, statisticians, wildlife biologists, public and private land managers, and energy representatives to develop a study design protocol. Consequently, *Protocol for Investigating the Effects of Tall Structures on Sage-grouse (Centrocercus spp.) within Designated or Proposed Energy Corridors* ('Protocol') was published in July 2011 (www.utahcbcp.org). The Protocol is designed to assess impacts on sage-grouse from tall structures, particularly high voltage power lines, thereby accomplishing **Goal 2**. The Protocol recommends rigorous, replicated research based on a "Before-After-Control-Impact" (BACI) study approach to address three specific research questions:

1. *Do sage-grouse avoid tall structures and if so, why?*

2. *Do tall structures increase avian predation by providing increased nesting and perching opportunities? If there is an increase in avian predation, is it significant to sage-grouse on a population level?*

3. *Do tall structures create fragmentation of habitat that limits use or movement of sage-grouse?*

On September 13, 2011, the EOC adopted the Protocol as a minimum protocol for researching the impacts of electric transmission and distribution lines on sage-grouse populations and habitat (See Appendix B). Further, the EOC adopted a series of recommendations from the Range-wide Interagency Sage-grouse Conservation Team (RISCT) regarding participation in the studies, determining study sites and funding research opportunities by using a portion of an authorized project's "unknown impacts" sage-grouse compensatory mitigation budget. The EOC and RISCT support the need for additional research in order to provide data on a large geographical scale to inform management decisions. Discussions from this group concluded that direct impacts will require mitigation, but unknown, indirect impacts, will be researched in order to inform future mitigation opportunities.

Research that follows the Protocol is necessary to adequately address **Goal 3** (siting and O&M criteria) and **Goal 4** (BMPs). However, because of the long timeframe required to conduct multi-year BACI studies, the need for voluntary interim BMPs was identified for the electric utility industry by APLIC member utilities. In October 2012, APLIC convened a sage-grouse/power line meeting and invited representatives from electric utilities, environmental organizations, academia, state and federal agencies, and other interested stakeholders. The group agreed there was a need to develop electric utility-specific BMPs to assist utilities in avoiding and minimizing potential impacts to sage-grouse. This document is a result of this effort among participating utilities and agencies. Like APLIC's other guidance documents, these BMPs will be evaluated and updated as needed to reflect future research and best practices.

4.1 Regulatory Framework

The following provides a brief overview of some of the federal and state legislative and regulatory compliance items applicable to electrical utilities that were considered in the development of this document.

4.1.1 Utility Operational and Reliability Requirements

The goal of electrical utilities is to provide their customers with a reliable and affordable supply of electricity while maintaining the overall integrity of the regional electrical grid. Utilities' obligations to maintain reliable operation of the electrical system are directed through compliance with industry standard codes and practices. The design, operation, and maintenance of electrical facilities must meet or exceed applicable criteria and requirements outlined by the Federal Energy Regulatory Commission (FERC), Western Electricity Coordinating Council (WECC), Midwest Reliability Organization (MRO), National Electrical Safety Code (NESC), and the U.S. Department of Labor Occupation Safety and Health Administration (OSHA) standards for the safety and protection of employees, landowners, their property, and the general public.

A key factor in providing reliable electricity is regular inspection and maintenance of power lines, structures, and associated facilities (substations, access roads, fiber optics, etc.). The Energy Policy Act of 2005 established a process for establishing mandatory reliability standards for power lines and provided incentives to transmission companies to upgrade and maintain existing facilities and penalties for non-compliance. This Act expanded FERC's authority to impose mandatory reliability standards on the bulk transmission system. This legislation authorized the creation of an audited self-regulatory electric reliability organization, the North American Electric Reliability Corporation (NERC) spanning North America, with FERC oversight in the United States. The Act states that compliance with reliability standards will be mandatory and enforceable.

Electric utilities are required to comply with the various reliability standards promulgated through the implementation of the NERC policies and procedures for those transmission facilities regulated under NERC/FERC (230 kV or above as well as smaller voltages that are critical to grid reliability). Additionally, electric utilities operating transmission lines in the western U.S., often times in areas that encompass greater sage-grouse habitat are subject to

WECC and/or MRO standards that may be in addition to or more stringent than those currently required by NERC. State Public Service Commissions or local jurisdictions may also impose inspection and corrective maintenance requirements upon utilities doing business within their states (which may also include distribution facility requirements). In response, many electric utilities have prepared internal operation and maintenance policies and procedures designed to meet the requirements of NERC, WECC, MRO and the state public utility commissions, with respect to maintaining the reliability of the electrical system. Electric utilities are required to provide electrical service to customers and may upgrade existing power lines and other facilities as well as construct additional power lines and generating capacity as necessary to meet customer needs. The above regulatory requirements and others (e.g., state fire/fuels reduction programs, renewable energy mandates) may dictate utility actions that in some cases may conflict with wildlife or habitat conservation efforts. Such examples may include:

- Applying minimum separations between lines to protect against a catastrophic event (e.g., wildfire, windstorm, plane crash) versus co-locating lines within the same corridor.
- Co-locating transmission and distribution lines in an existing right-of-way may not always be feasible due to National Electric Safety Code standards, which identify necessary clearances for the safe and reliable operation of power lines.
- Conducting vegetation management during high fire risk periods may overlap with bird nesting seasons, particularly in high elevation areas that may not be accessible during the nonbreeding season.
- Providing required service to customers that may be located in environmentally sensitive areas.
- Constructing new transmission lines to connect new renewable and conventional generation sources (often in remote areas) to load centers in urban areas can create new infrastructure in or across habitats that may be otherwise undisturbed.
- Responding to necessary emergency maintenance needs that occur during seasonal restrictions for sensitive wildlife species such as sage-grouse.

4.1.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) is a process that requires federal agencies to integrate environmental values into their decision-making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. The NEPA process involves many steps, some of which are iterative, and includes identification of design features (standard operating procedures, stipulations, and best management practices) as well as potential mitigation measures to reduce or avoid adverse impacts. The direct, indirect and cumulative impacts of the proposed action and alternatives are analyzed and the process results in a decision. Implementation of an action, including any mitigation and monitoring measures adopted, must be in accordance with the decision.

The NEPA process evaluates impacts and informs agency decisions to authorize a proposed action, authorize with conditions, or deny the action. The USFWS has determined that lack of adequate regulatory measures is one of the listing criteria identified for sage-grouse. In order to address this issue, the federal land management agencies that have sage-grouse within their management districts are re-evaluating and amending their land management planning documents. Changes to BLM Resource Management Plans (RMPs) and U.S. Forest Service (USFS) Forest Management Plans (FMPs) for sage-grouse management require the agencies to review proposed changes through the NEPA process. This includes completing an alternatives analysis, collecting public comment, and reviewing the environmental impacts associated with the proposed changes in management. The NEPA process is intended to help public officials make decisions that are based on the best available science and an understanding of potential environmental consequences, and then take actions that protect, restore, and enhance the environment. Analysis and disclosure of effects of a proposed action and its alternatives are the underlying NEPA principles and these environmental analysis documents must be made available to the public.

The analysis would also include an assessment of impacts and potential best management practices and mitigation measures to be implemented to avoid, minimize, and lastly mitigate impacts to species and their habitats. Changes that are proposed must be consistent with and compatible with authorized uses and overall agency objectives. The BLM and USFS are currently involved in the NEPA process to amend their resource and forest management plans to incorporate sage-grouse conservation measures.

All actions approved or authorized by the BLM must conform to the existing Land Use Plan (LUP) as dictated by the Federal Land Management Policy Act (FLMPA 1976). The BLM LUPs are designed to provide guidance for future management actions and the development of subsequent, more detailed and limited-scope plans for resources and uses. A proposal for use or development of resources on lands administered by BLM must be determined to be in conformance with the LUP. If the proposal is in conformance with the LUP, the federal action on the proposal triggers NEPA. The BLM follows the Council on Environmental Quality (CEQ) regulations to comply with NEPA.

Similar to the BLM, the USFS approved or authorized actions must conform to the National Forest Management Act and the local Forest Management Plans. Forest Management Plans are designed to provide guidance for future management actions and the protection of resources. The USFS also incorporates CEQ regulations to comply with NEPA.

4.1.3 Endangered Species Act

The Endangered Species Act (ESA) (16 U.S.C. 1531-1544) was passed by Congress in 1973 to protect our nation's native plants and animals that were in danger of becoming extinct and to conserve their habitats. Federal agencies are directed to use their authority to conserve listed species, as well as "candidate" species, and to ensure that their actions do not jeopardize the existence of these species. The law is administered by two agencies, (1) the USFWS and (2) the Commerce Department's National Marine Fisheries Service (NMFS). The USFWS has primary responsibility for terrestrial and freshwater organisms, while the NMFS has primary responsibility for marine life. Section 7 (a)(1) of the ESA charges Federal agencies to aid in the conservation of listed species, and section 7 (a)(2) requires the agencies, through consultation with the USFWS and/or NMFS, to ensure that their activities are not likely to jeopardize the continued existence of listed species or adversely modify designated habitats. These two agencies work with other federal agencies and/or project proponents to plan or modify projects with a federal nexus or connected actions to minimize impacts on listed species and their habitats. Protection is also achieved through partnerships with the states, with federal financial assistance, and a system of incentives that encourage state participation. The USFWS also works with private landowners by providing financial and technical land management assistance for the benefit of listed and other protected species. For more information on ESA, see http://www.fws.gov/laws/lawsdigest/esact.html.

4.1.4 Bald and Golden Eagle Protection Act

Under the authority of the Bald and Golden Eagle Protection Act of 1940 (BGEPA) (16 U.S.C. 668-668d) as administered by the USFWS, bald (*Haliaeetus leucocephalus*) and golden (*Aquila chrysaetos*) eagles are afforded additional legal protection (both species are also protected under the Migratory Bird Treaty Act [MBTA], see below). *Take* under BGEPA is prohibited unless permitted, and defined as "to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb". "Disturb" under BGEPA is defined in regulation as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." For more information on BGEPA, see **http://www.fws.gov/laws/lawsdigest/baldegl.html**.

4.1.5 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 (MBTA) (16 U.S.C. 703-712), administered by USFWS, is the legal cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide international protection for migratory birds. It is a strict liability statute meaning that proof of intent is not required in the prosecution of a "*taking*" violation. Most actions that result in *taking* or possessing (permanently or temporarily) a protected species can be violations.

The MBTA states: "Unless and except as permitted by regulations… it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill… posses, offer for sale, sell…purchase…ship, export, import…transport or cause to be transported…any migratory bird, any part, nest, eggs, of any such bird, or any product… composed in whole or in part, of any such bird or any part, nest, or egg thereof…" Unlike BGEPA, there is no disturbance clause in the MBTA (disturbance that does not result in a "take" is not unlawful under MBTA).

A 1972 amendment to the MBTA provided legal protection to birds of prey (e.g. eagles, hawks, falcons, owls) and corvids (e.g. crows, ravens). The MBTA currently protects 1,026 migratory bird species, including waterfowl, shorebirds, seabirds, wading birds, raptors and songbirds. The MBTA protects most birds native to North America, and excludes house sparrows (P*asser domesticus*), European starlings (*Sturnus vulgaris*), rock doves (*Columba livia*), any other species published in the Federal Register, and non-migratory upland game birds, such as sage-grouse. Sage-grouse are not protected by the MBTA, however avian predators of sage-grouse are protected. For more information on MBTA, see http://www.fws.gov/laws/lawsdigest/migtrea.html.

4.2 Overview of Sage-Grouse Ecology

The greater sage-grouse is the largest grouse in North America and is a sagebrush (*Artemisia* spp.) obligate (Patterson 1952). The sage-grouse belongs to the order Galliformes, and the family Phasianidae, which includes grouse, partridges, pheasants, ptarmigan, quail, and turkeys. It is a member of the Tetraoninae subfamily and the Centrocercus genus, which includes the Gunnison sage-grouse (*C. minimus*).

Population estimates of greater sage-grouse have declined 17 to 47% across their range (Connelly and Braun 1997). Sage-grouse occupy approximately 56% (670,000 km^2) of their potential pre-settlement range, which once covered approximately 1,200,000 km^2 (Schroeder et al. 2004). This decrease has been attributed to the fragmentation, degradation, and loss of the original sagebrush habitats (Braun 1998). The species is currently found in 11 states and 2 Canadian provinces (Connelly et al. 2004).

Sage-grouse breed on traditional display sites called leks (Patterson 1952). Sage-grouse are polygynous; females attend leks where the males display and males copulate with multiple females. Subsequently, females nest, incubate, and raise the broods on their own (Bergerud 1988). After breeding, females typically move from 1.1 to 6.2 km from the lek to a nest site (Connelly et al. 2000, Peterson 1980, Wakkinen et al. 1992, Schroeder et al. 1999, Wiechman 2013). This breeding and nesting habitat can greatly affect population dynamics such as nest initiation rates, clutch size, and reproductive success, based on the condition and diversity of the vegetation (Barnett and Crawford 1994, Coggins 1998). Fluctuations in annual precipitation influence vegetation communities, which can in turn affect sage-grouse populations from year to year (Coggins 1998).

The date of nest initiation varies from April to early June, depending on elevation, and other environmental factors (Schroeder et al. 1999). Clutch size can include up to 10 eggs, with a mean clutch size of 7.5 and 7.1 in the eastern and western portions of the range, respectively (Schroeder et al. 1999). Clutch size is typically higher for adults than yearlings across the range (Wallestad and Pyrah 1974, Peterson 1980, Hausleitner 2003). Incubation typically lasts 27 days (range is 25 to 29 days) beginning after the last egg is laid (Patterson 1952, Schroeder 1997). Nest success varies across the range from 15-86% with higher nesting success occurring in stable populations (Schroeder et al. 1999). Sage-grouse typically nest in areas dominated by big sagebrush and relatively thick vegetative cover (Patterson 1952, Gregg et al. 1994) with greater success occurring in areas with greater canopy cover (Wallestad and Pyrah 1974, Gregg 1991). In addition to vertical and horizontal structural diversity (Wakkinen 1990, Gregg 1991, Schroeder et al. 1999, Connelly et al. 2000), grass height and cover are important factors in nest site selection (Connelly et al. 2000, Kolada et al. 2009).

Habitat used by successful broods for up to three weeks post-hatching are defined as early brood-rearing habitats (Connelly et al. 2000). Early brood-rearing habitat is also characterized by an abundance of forbs and insects as food for females and chicks (Drut et al. 1994, Apa 1998, Connelly et al. 2000). In late summer, as vegetation and habitat dries out, sage-grouse will move to more mesic areas (Fischer et al. 1996, Schroeder et al. 1999, Connelly et al. 2000, Braun et al. 2005), with enough moisture to maintain forbs throughout the summer (Fischer et al. 1996, Hausleitner 2003).

As fall transitions to winter, the diet of sage-grouse is dominated by sagebrush leaves, providing >99% of the food eaten (Patterson 1952). Several factors influence sage-grouse habitat selection during winter, including snow depth and hardness, topography, and vegetation height and cover (Beck 1977, Schoenberg 1982, Robertson 1991, Schroeder et al. 1999). Sage-grouse may select wintering areas with sagebrush canopy cover varying from 6–43% (Schroeder et al. 1999), but typically choose canopy cover between 10–25% (Wallestad 1975, Robertson 1991, Connelly et al. 2000, Braun et al. 2005). As winter ends, sage-grouse flocks move towards breeding habitat that may be near or far from wintering ranges (Connelly et al. 2000). Although sage-grouse may have distinct seasonal ranges, some populations may have seasonal ranges that overlap or may be integrated (i.e., winter range may overlap or be near active leks; Connelly et al. 2000).

4.3 Overview of Power Line Infrastructure and Terminology

Figure 1 shows a schematic of power system from generation to customer (from APLIC 2006). Power is taken from a generation source and transmitted via ***transmission*** lines to substations where voltages are lowered. The power is then distributed via ***distribution*** lines to service homes, business, and industry.

Power lines are rated and categorized, in part, by the voltage levels to which they are energized. Because the magnitudes of voltage used by the power industry are large, voltage is often specified with the unit of kilovolt (kV) where 1 kV is equal to 1,000 volts (v). In addition to the voltage level, power line classification is dependent on the purpose the line serves (see Figure 2). See Appendix C for example photos of different power line configurations.

A power line's voltage, configuration, conductor design and spacing, location, and structure type are determined by the present and anticipated power demands or load requirements the line will serve. For example, if a customer in an agricultural area requested service for a new irrigation pump, a distribution line may be necessary. If more energy is needed to meet the increasing electricity demands of a growing population center, a transmission line may be required to bring power to the load center, sometimes across great distances. Siting of new or upgrading of existing power line corridors and ROWs, and associated features must consider existing biological, cultural, and visual as well as land use, land management, and local, state, and federal regulatory agency guidelines, as well as a number of other aspects. When siting a new or upgrading an existing power line and associated features, utility companies must consider these environmental aspects as well as land ownership, land use, engineering, and reliability factors in order to determine the best route.

Figure 1. Schematic of power system from generation to customer (from APLIC 2006).

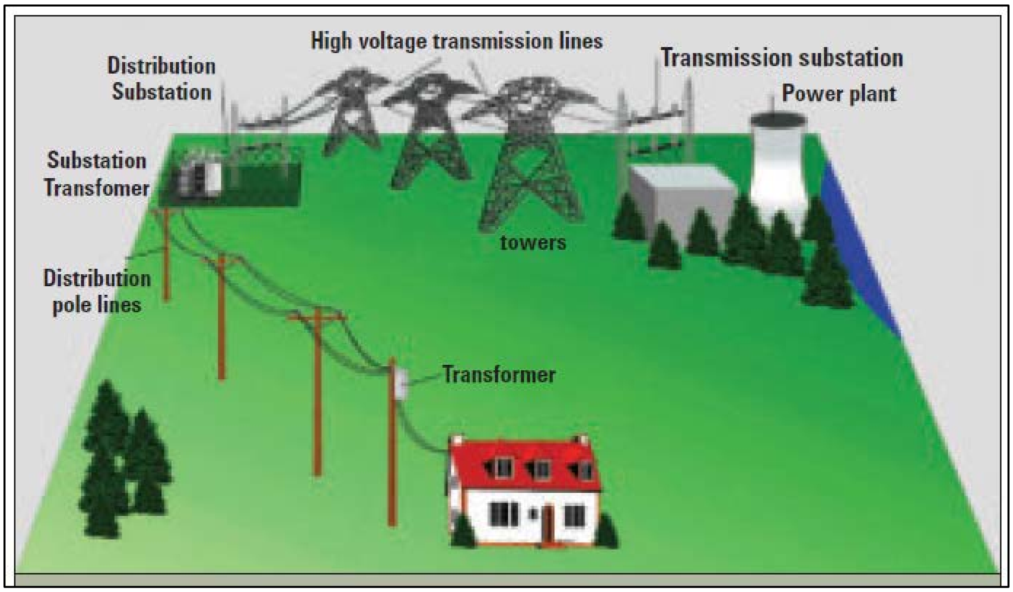


Figure 2. Voltage ranges of different power line classes (from APLIC 2006).

Designation	Voltage Range
Generation plant	12 V to 22 kV
Transmission	60 kV to 700+ kV
Distribution	2.4 kV to 60 kV
Utilization	120 V to 600 V

ROW widths vary based on requirements for different power line voltage ratings and clearances that are generally determined by engineering and reliability standards, state statues, and NESC. ROW widths are also a function of the structure design, span length, conductor to ground clearances, vegetation and the conductor sag. ROW widths for transmission lines vary from 50 feet to more than 250 feet. The higher the voltage, the greater the ROW width required for the safe operation of the line. ROW widths for distribution lines typically vary between 30 feet and 40 feet. Because new ROWs are becoming increasingly difficult to obtain, it is a common practice to rebuild an existing line at a higher voltage in existing ROWs when engineering and safety considerations allow; in such cases additional ROW may need to be secured.

Electric utilities install power lines either overhead or underground depending upon numerous considerations. Some key factors include customer needs, costs, code requirements, terrain, voltage, and technological, land use, and environmental restrictions. Electric utilities have a legal obligation to ensure the provision of safe, adequate, and reliable service at the lowest cost possible (Public Service Commission of Utah. 2012). See Appendix A for a more detailed discussion of underground power line considerations.

4.4 Siting and Routing Considerations

Siting and preparation for routing new power lines requires an open and comprehensive process that balances various factors including electric (power) system planning, the natural, human, and cultural environment, public involvement, local, state, and federal regulatory requirements such as those outlined under NERC/FERC, resource objectives, land rights, land use, economics and engineering. The utility must select a route that minimizes overall impacts to the greatest extent feasible while still complying with federal reliability requirements, resource agency objectives, environmental regulations, landowner concerns, local land use planning objectives, and reducing financial liabilities and costs to ratepayers or members.

Specific requirements depend on location, voltage, and length of the power line. There are times when no environmental regulatory requirements may apply to power line siting. Generally, this occurs if the power line being sited involves urban areas, lower voltages, short span additions, or for certain private lands. In regards to sage-grouse, there is a potential that power lines could be sited within sage-grouse habitat. Areas outside of priority conservation areas maybe identified as an opportunity for siting a new transmission line. These areas may or may not require conservation measures. BMPs outlined in this document could be implemented in these areas to further minimize impacts to sage-grouse and their habitats. Conservation measures may still be required or recommended in non-priority habitats, or adopted proactively by utilities. Ultimately, utilities will follow the federal, state and local siting requirements and consultation processes, as applicable, for siting power lines to avoid and minimize impacts to sage-grouse in areas where these stipulations apply as well as adopt other conservation measures such as implementation of BMPs as appropriate. These BMPs will provide a benefit to sage-grouse regardless of land ownership and/or habitat designation.

4.5 Considerations for Upgrading or Operating Existing Power Lines and Features

Utilities may upgrade existing facilities to reduce environmental and land use impacts as well as reduce costs from creating and acquiring a new transmission ROW. For transmission upgrades and operation of existing facilities, it is important to incorporate BMPs such as seasonal buffers and timing restrictions into the early planning process to avoid activities in crucial sage-grouse habitats at crucial times (breeding and nesting). Efforts to reduce disturbance during maintenance activities are effective ways to minimize impacts to sage-grouse.

Often times, existing facilities have existing access roads or a historic road network that can be utilized to reduce the need to disturb additional habitats. Early on in the planning process for transmission upgrades, utilities can identify existing access roads and disturbed areas, if available, for staging and other temporary use areas.

Federal and state agencies have identified re-routing of existing facilities outside of crucial sage-grouse habitats as a conservation measure. Re-routing existing lines is generally not a feasible option from environmental, land use, and cost perspectives. Re-routing existing lines requires new disturbance and new environmental and land use impacts. Existing lines may have been constructed decades prior, or vegetation reclaimed/restored. Re-routing a line entirely outside of crucial habitat can also be a challenge in certain areas depending on the extent of the habitat in the area. Other resources such as federally listed plants and wildlife, cultural resources, wetlands and riparian corridors, and other factors must be taken into consideration when evaluating re-routes of existing infrastructure. In addition to environmental concerns, utilities must also consider potential impacts to land use and landowners in the area. New routes require the acquisition of new ROWs. Re-routes where no upgrades are required are a cost concern to utilities and pose a significant added cost to customers. Given these concerns and the lack of empirical data documenting negative impacts of existing lines or quantifying benefits of line relocation, relocation would not likely be feasible in most cases. The removal activities could result in impacts to sage-grouse and their habitat.

5.0 Utility Construction Activities

Construction of power lines is a sequenced and planned process with timing goals, specific construction practices, and proactive measures to reduce power line footprints on the ecological landscape. Depending on the type of line being constructed, there are several different construction practices that a utility undertakes. For a video demonstrating transmission line construction, see http://www.gatewaywestproject.com/construction.aspx. Lines are often constructed in segments and depending on the length, type, and configuration of the line/structures there could be multiple crews working at different time or line segments. Typically, crews are assigned specific tasks and work their way along the ROW. For example, a crew may be responsible for drilling pole holes. They would drill pole holes the length of the ROW and another crew would follow behind them assembling and erecting structures. Once a sufficient number of structures have been erected, another crew would start stringing and tensioning conductors. This type of construction often results in periods of high activity at a particular location followed by periods of low to no activity as crews follow each other.

When building a power line, a typical construction sequence begins with building access roads and pad sites as needed, throughout the corridor to construct the power line and provide access to conduct maintenance during the life of the line. Access road size generally depends on the largest piece of equipment that would travel on the road during construction. Second in the construction phase is site preparation, and constructing staging areas and substation sites, which also require access. During the processes, erosion control is minimized by installing water bars, waddles/silt fences, culverts, and sediment basins or other appropriate controls in order to reduce impacts to water quality and water resources, including wetlands.

Construction for power pole foundations differ, depending on the type of structure needed. Assembling high voltage structures typically involves delivery of components for each structure by a flatbed truck with assembly done onsite. As construction takes place, a crane moves along the ROW to set each structure in place, and in some cases, a helicopter may be necessary.

Construction of wood pole structures typically requires poles be embedded in the soil and does not require a foundation. Rather a hole is augured, to a depth equaling about 10% of the overall height of the pole plus two feet. Wood structures (single pole and H-frame) are framed on the ground at the structure site and set in place by a truck-mounted crane. The wood pole is placed within the hole and soils or crushed rock is backfilled around the pole and compacted.

Foundations are generally required for steel structures. Typical foundations are made of steel reinforced concrete piers. The foundation diameter and number of foundations needed for a structure vary depending upon structure type. For example, steel lattice structures require four foundations that are generally four feet in diameter and 15 feet deep, though these numbers may vary dependent on the soil or rock type at each site and the size of the structure. Reinforced steel anchor bolt cages are installed after excavation of the foundation holes and before concrete placement to strengthen the foundation’s structural integrity. Concrete foundations typically extend about two feet above the ground. Steel lattice structures are assembled in sections using a truck-mounted crane or similar equipment, and then lifted onto the foundation using a large crane specifically designed for tower construction.

Once structures are in place, the line, or conductor, is strung. Temporary pulling work sites are set up for the equipment used to pull and tighten the conductor. The spacing of these along a line depends upon the span length, size of the conductor, and length of conductor on a reel. Often time the initial stringing begins with a helicopter pulling a lighter weight sock line through sheaves attached to each tower. A specialized wire-stringing vehicle is attached to the line to pull it through, followed by tightening or tensioning the line to achieve the correct sagging of the conductor wire between support structures. In lieu of using a helicopter for this work, some utilities use a pickup to pull the lighter weight sock line with a bucket truck placing the line in the sheaves of the structures.

Construction duration varies greatly depending on several influencing factors such as structure design, access needs, ease of access, amount of site preparation required (vegetation pruning or removal), project length, availability of materials and construction equipment, availability of construction resources (crews/contractors), and environmental/land use restrictions. The length of the project is an important influencing factor in determining the duration of construction. In general, the longer the project the faster the project may be constructed on a per mile basis. This is because, in a typical project setting, the construction contractor utilizes more crews to construct the project, thereby facilitating faster construction on a per mile basis. Figure 3 shows examples of construction durations for typical construction of distribution, low voltage transmission, and high or extra high voltage transmission. Actual construction durations may vary from the typical durations/examples presented. In order to estimate durations on a per mile basis, typical project lengths were assumed (Project Length column of Figure 3). For example, as presented in Figure 3, a 50-mile length of high voltage transmission line may be constructed at a pace of 1-2 weeks per mile. In contrast, a 5 mile distribution line may be constructed at 2-3 weeks per mile since fewer construction resources (construction crews) may be utilized.

Figure 3. Example Durations for Construction of Power Lines

Voltage Classification	Project Length	Structure Type	Terrain	Duration per Mile
Distribution	5 miles	Single wood pole	Flat, sagebrush	2-3 weeks per mile
Low Voltage Transmission	20 miles	Single wood pole	Flat, sagebrush	2-2.5 weeks per mile
High or Extra High Voltage Transmission	50 miles	Steel pole/lattice with foundations	Flat, sagebrush	1-2 weeks per mile

Equipment utilized during construction will vary depending upon the voltage class, but may include the following types of equipment: 4-wheel drive trucks, material (flatbed) truck, bucket truck (low reach), boom truck (high reach), man lift, excavator, bulldozer, pulling and tensioning equipment, truck or track mounted auger, truck-mounted crane, track-mounted crane or specialized crane, helicopter, etc.

Only the area required to construct the power line in a safe and efficient manner is generally disturbed (construction footprint). In some cases, the construction footprint may be larger than the operational footprint (permanent area needed for operations). Disturbed areas around the structures and temporary work areas are restored and re-vegetated, as required by the property owner or land management agency. All practical means are used to return land to its original contour and natural drainage patterns along the right of way where feasible. However, utilities may not re-vegetate within a 10 to 20-foot diameter circle around wood poles to protect them from range fires.

6.0 Utility Maintenance Activities

6.1 Access Requirements

Federal land managers administer ROW grants and issue easements on federal lands for construction, operation and maintenance of power lines. ROW grants issued prior to the enactment of the Federal Land Policy and Management Act (FLPMA) may or may not be clear on right of use or designation of access routes to existing power lines but the right to maintain and operate is either directly expressed or implicitly understood in each grant or easement. In many cases, a utility's specific ROW grants, easements or special use permits authorize the construction, operation and maintenance of an "Electric Power Line" and authorize access to the power line and ROW. Most federal land managers recognize the need for a utility to access its power lines since the operation, maintenance and emergency repair of the power lines cannot be accomplished without reasonable access for vehicles and personnel. In most situations, this can be accomplished by using historical or existing roads and trails used during original line construction (sometimes >40 years ago) but in some cases, the use of overland travel or improvement to historic access routes is required. The current condition of power line access roads varies greatly between utilities and across geographic areas: some roads may be adequate for routine line maintenance activities, while in some situations there may be a need for seasonal or occasional access road maintenance or improvements (generally site-specific activities), relocation or recreating. Maintenance on access roads is not conducted without the authorization of the land managing agency or private landowner unless in response to emergencies or otherwise authorized in grant or easement. In many districts, the BLM and USFS have or are currently revising their Travel Management Plans and it is crucial that access to utility infrastructure is included in the revised plans.

Most land management plans and ROWs restrict the use of vehicles under poor weather conditions when ruts may result from vehicles in wet soils, seasonally in areas of sensitive resources such as occupied sage-grouse habitat, or in special management areas. APLIC members have power lines that serve facilities within some special management areas or have power lines within or adjacent to sage-grouse habitat. Because utilities must have access to inspect or repair their structures and facilities in these sensitive areas, this document includes BMPs to minimize impacts to these habitats or special management areas.

In the event of an emergency, a utility must respond as quickly as possible to address safety issues and restore power; this may require actions beyond those authorized in ROW grant(s) and/or easements. This may include travel outside of designated access roads, construction of new access routes, or improving access roads without prior review or approvals. The land manager or landowner would be notified of the emergency and actions taken in concurrence with the utility responding to the emergency. The utility and resource agencies or landowner would then work together to identify and implement appropriate restoration or remedial measures after the emergency has been addressed. Establishing access roads, pad sites, and other work areas that can be used in a routine and emergency situation in cooperation with land managers and land owners is a way to proactively reduce impacts and ensure crews can stay within authorized transmission and access ROWs.

6.2 Maintenance Requirements

Maintaining the tens of thousands of miles of power lines that cross sage-grouse habitat in the western U.S. requires the time and effort of many employees as well as the deployment of various vehicles and equipment. Dispatchers located in strategic locations and urban areas manage the operations of energy loads on power lines. The flow and amount of electricity on a utility's lines is dictated by the size of the line and its capacity rating, consumer demands, generation production, price, and available capacity on the power lines themselves. Time of day and seasonal fluctuations in customer demand are also factors in the flow of electricity through a power line at a particular point in time.

Field maintenance activities may include the following three categories, each of which is detailed in subsequent sections:

- Routine maintenance (inspections, corrective actions, and vegetation management) (See 6.2.1)
- Major corrective actions (See 6.2.2)
- Emergency activities (See 6.2.3)

6.2.1 Routine Maintenance and Inspections

Routine inspection and maintenance activities are ordinary maintenance tasks (see Figure 4) that have historically been performed and are regularly carried out on a routine basis within the bounds of the existing power line and access road ROW authorizations. These actions generally would not require new ground disturbances unless needed for access or to set up equipment in a safe position around the pole. If any ground disturbance takes place, it is within the existing ROW and construction footprint (areas previously disturbed). Because these actions are considered authorized under the existing ROW grant, they generally do not need additional land manager or agency approvals unless there is a federally listed species or eligible cultural resources in proximity to the work area. Utilities should check with their local ROW grants to identify terms and conditions associated with grants.

Safety Inspection

Utilities are required to perform safety inspections of their power lines on a cycle that can vary from multiple times per year to every few years. Inspection frequency, which is dependent on location and voltage, is dictated by utility regulatory agencies. Inspections are performed by an inspector via a 4-wheel drive pickup, 4-wheel drive all-terrain vehicle (ATV), or from the air via a helicopter or fixed wing aircraft. In some cases, the inspector walks the ROW. The inspector assesses the condition of the power line structures, conductors, and hardware to determine if any components need repair or replacement, or if other conditions exist that require maintenance or modification. The inspector could also note any encroachments on the ROW that could constitute a safety hazard or are unauthorized. The inspector accesses locations along each line and uses binoculars and/or spotting scopes to perform this inspection.

Detailed Inspection

Detailed inspections of an electric utility's transmission and distribution facilities occur on cycles determined by federal reliability standards, state requirements, and the utility's internal operating procedures. The inspector will access all structures of the identified line and check all equipment and other components to determine if repairs or maintenance activities are required. Inspectors performing this work use conventional 4-wheel drive trucks, 4-wheel drive ATV's, snowcats, or the inspector may walk the line. Helicopters or airplanes are used to conduct aerial inspections, but are typically not utilized for detail inspections. Due to their costs, aerial inspections are often limited to transmission lines in remote areas or with rugged terrain. Aerial inspections help identify the locations where detailed inspections are necessary, and can minimize inspection needs on the ground in sage-grouse habitat if no concerns are observed during aerial inspections. Inspectors may view the line using binoculars (aerial and ground inspections) and/or spotting scopes (ground inspections). Minor repairs to structures might also be done during detailed ground inspections.

Figure 4. Examples of Routine Maintenance Activities[3]			
Activity	**Description**	**Equipment**	**Frequency/ Duration**
Aerial Inspection	Visual inspection of lines and poles to detect any safety or operational problems and nests on structures	Helicopter or fixed wing aircraft	Annual or semi-annual/Day(s) for a line, minutes per each structure
Ground Inspection	Visual and physical inspection of lines and poles to detect any problems	ATV 4wd truck	Semi-annual or annual/Day(s) for a line, minutes per each structure
Access Road Maintenance	Removal of access road obstructions	4-wd truck, back hoe	As needed/Day(s)
Guy Wire Tightening	Tightening guy wires	Bucket truck or boom truck	As needed/Days
Problem Bird Nest Management	Addressing bird nests that pose a fire threat, hazard to the bird or potential power outage. Actions may include nest removal or relocation, nest platform installation, and/or pole modifications to discourage re-nesting[4]	Bucket truck or boom truck	When problem nests are identified/Hours or Day(s)
Crossarm Replacement	Installing new crossarm on pole	Bucket truck or boom truck	As needed/Hours
Crossarm Reframing	Lowering crossarm to obtain avian-safe separations[4]	Bucket truck or boom truck	As necessary/Hours

[3] Note: these are common examples; actual equipment, activities, frequency, and duration will vary by utility and project.

[4] See APLIC (2006) for more details on management of nests on utility structures and associated permitting requirements.

Hardware Tightening	Tighten existing hardware on structure	Boom truck or bucket truck	As needed/Hour(s)
Insulator Replacement or Conductor Repair	Replacement of an insulator upon failure or repair of a broken conductor	Bucket truck or boom truck	As needed/Hours or Day(s)
Installing Bird Protection Measures	Installing protective covers, line markers or other devices intended to minimize electrocutions or collisions[5]	Bucket truck or boom truck	When problem structures are identified/Hour(s) or Day(s)
Pole Testing and Treatment	Taking core samples from poles and treating poles with chemical preservative	ATV 4-wd truck	Day(s) to week(s)[6]
Pole Replacement	Individual pole replacement in same location	Bucket truck or boom truck	When problem structures are identified/Day(s)
Vegetation Management	Pruning or clearing of undesirable vegetation and danger trees[7] from ROW and hazard trees that are within the ROW or adjacent to the ROW	ATV, 4-wd truck, bucket truck, chainsaws, mower or sprayer (herbicide use)	Day(s) to week(s)

Wood Pole Test and Treat

Many utilities have a wood pole test and treat program. Each pole could be tested on a five- to 20-year cycle. This program includes hand excavating around the wood pole, completing a detailed inspection of the wood pole at the ground line (to determine extent of wood rot) and re-treating that portion of the wood pole if necessary. Core samples from the wood pole may also be taken, and poles may be treated with an approved chemical preservative. Access to structures

[5] See APLIC (2006 and 2012) for additional information on preventing avian electrocutions and collisions with power lines.

[6] Cycle dependent upon area. See section 6.2.1 for discussion of routine maintenance cycles.

[7] Danger and hazard trees as defined in American National Standards Institute (ANSI) A300.

is with four-wheel drive trucks or 4-wheel drive ATV's. Associated work included in the detailed inspection may also be performed at this time. Impacts are limited to the area around the poles and would occur entirely within the permitted ROW.

Outage Cause Inspection

In the event of an outage or interruption in the transmission and distribution of electricity on power lines, a utility will typically conduct an inspection (aerial or ground) to determine the cause of the interruption. Outage cause inspections utilize similar equipment and points of access as the other above listed inspections. In addition, trouble trucks (typically a 4-wheel drive truck with a personnel bucket to lift employees to the pole) are used to gain access to the pole for a lineman to determine the cause of the outage. Depending on the type of repair work needed and a utility's safety requirements, work may be done by a single troubleman or crew(s) may be needed. The type of repairs and needed crew compliment will dictate the number and type of vehicles used. This inspection may take place at any time of the day or night and result in emergency repairs.

Corrective Routine Maintenance

Routine maintenance activities are ordinary maintenance tasks historically performed and carried out on a regular basis and generally authorized under the ROW grant through the BLM, private easements, or a Special Use Permit with the USFS. The work performed is typically repair or replacement of individual components, performed by a relatively small crew using a minimum of necessary equipment, and usually conducted within a period from a few hours up to a few days. Work requires access to the damaged portion of the line to allow for a safe and efficient repair of the facility. Equipment required for this work may include a 4-wheel drive truck, material (flatbed) truck, bucket truck (low reach), boom truck (high reach), excavator, or man lift. This work is scheduled and is typically required due to issues found during inspections. For non-emergency or non-urgent repairs, timing or seasonal restrictions can be considered when scheduling this work in designated sage-grouse habitat (see BMP section).

Vegetation Management

The objective of a utility's Vegetation Management Program (VMP) is to manage vegetation in order to prevent threats to the safe and reliable operation of the electric grid. These threats include trees that could grow-in, fall-in, or blow into the power line. Utilities manage vegetation in a cost effective and environmentally conscientious manner, and within the stipulations outlined in permits, grants, and easement documents. Vegetation management may occur as emergency response to remove branches or trees fallen on power lines (e.g. during storms), and as routine maintenance of existing power line corridors.

Some utilities use the integrated vegetation management (IVM) technique to remove trees and manage undesirable vegetation (e.g., tall, fast growing species). The goal of IVM on utility rights-of-way is to establish sustainable stable, low-growing plant communities that are compatible with power lines and discourage undesirable tall vegetation that could pose potential safety, access, fuel load, or reliability problems. IVM requires a combination of manual, mechanical and herbicide control methods. Equipment and materials will vary with each control method selected and site-specific conditions. Utilities require access to and along the entire power line ROW when conducting vegetation management.

With proper IVM, the low-growing vegetation can eventually dominate the right-of-way, inhibit tall-growing vegetation or incompatible species, and reduce the need for future treatments. Establishing native vegetation will also reduce the occurrence of noxious or invasive weeds into the corridor, and can help reduce the risk of fire.

IVM techniques include but are not limited to:

- Manual and mechanical cutting, where wood debris is left on site to enrich the soil. Use of hand-operated power tools (chainsaws), mechanical equipment, and hand tools to cut, clear, or prune herbaceous and woody target species.

- Cover type conversion, which uses herbicides in combination with manual/mechanical cutting to remove incompatible tall-growing trees and other vegetation from the right-of-way in order to establish a stable, low-growing plant community.

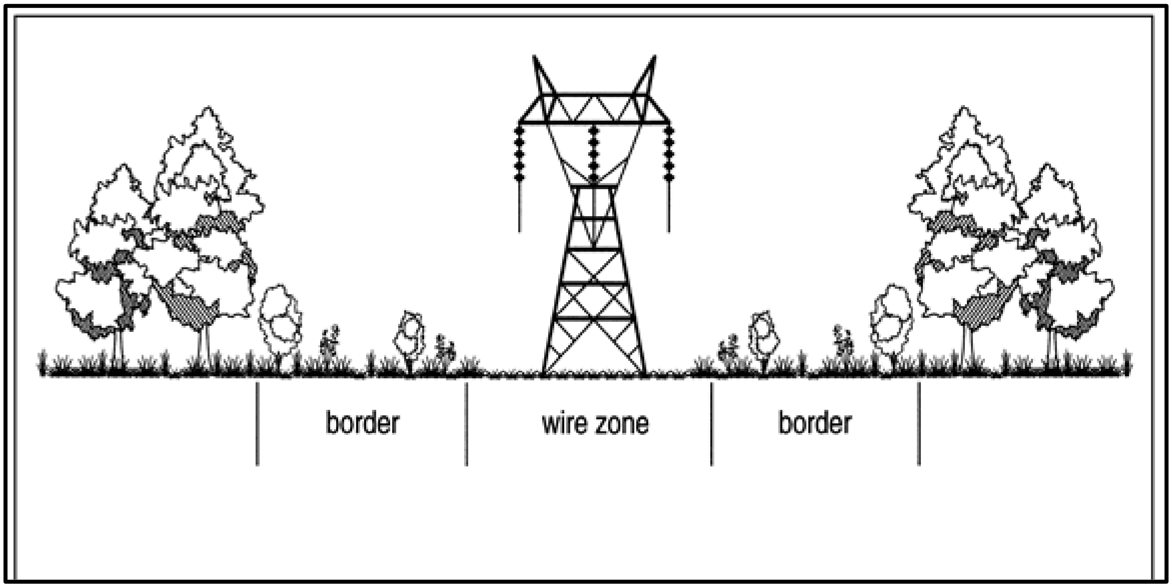
Removal of trees could occur under the following circumstances:

- Most trees growing directly below **distribution lines** (e.g. the "Wire Zone") are typically pruned for clearance but maybe removed depending upon line height, species, tree condition, and land owner directives.

- All trees located beneath the wire zone of **transmission lines** with 50ft or less of ground clearance are typically removed.

- Tree removal would be limited to the ROW corridor and would target only tall-growing and hazard trees (e.g. for removal, in the border zones). An example of tree removal near transmission lines is provided in Figure 5 below.

Figure 5. Example of border/wire zone using Integrated Vegetation Management.



6.2.2 Major Corrective Maintenance Activities

Major corrective maintenance activities, such as replacement or rebuild activities (see Figure 6), are planned efforts that are relatively large in scale (either through number of poles, duration, etc.) that occur on an infrequent basis, and may require ground disturbance within and outside of the existing ROW. Facilities may require replacement due to human- or natural-caused damages, age of facility, or other factors. This work generally is planned and encompasses more work than defined by routine or under emergency activities. It may involve multiple structures, larger work crews, a variety of equipment, including heavy equipment, and usually take weeks or months to complete. Equipment that may be involved can include 4-wheel drive trucks, man lifts, material (flatbed) truck, bucket trucks, boom truck, tractor trailer, snow cat, excavator (back hoe or track hoe), grader, concrete truck, pumping equipment crane, etc. (see Appendix D for example photos of construction equipment).

Major corrective activities may include conductor replacement, which may be done to increase capacity on a line or for repairs. Generally, many miles of conductor could be replaced during one project. This would require the use of staging, pulling, or lay-down areas for wire and equipment. Another example of a major corrective action would be substantial access road improvement and/or relocation, which may require modifications to existing permits/easements. This could involve grading outside of the authorized ROW and repair or installation of culverts and drains. New access to or along the power line ROW may be required and timing or seasonal restrictions should be considered for work within sage-grouse habitat (see BMP section).

Projects that involve multiple-structure relocation or replacement would typically be considered major corrective actions. These activities would have similar footprints and durations of new construction activities within the project area.

Figure 6. Examples of Major Corrective Maintenance Activities[8]

Activity	Description	Equipment	Frequency/ Duration
Multiple Structure Relocation or Replacement	Create staging pad and pole laydown area, dig new pole holes and anchor holes, frame structures, remove old poles	4wd truck, boom truck, excavator, bulldozer or other tracked vehicle, bucket truck, helicopter or crane, material truck	As needed/Days to weeks
Anchor Replacement	Installation of new anchor	4wd truck, back hoe	As needed/Days
Conductor Replacement	Replacing conductor typically associated with a non-emergency pole change-out	4wd truck, boom truck, bucket truck, material truck, crane or helicopter	As needed/Days to weeks
Access Road Improvement and Relocation	Altering the alignment of any existing access routes, creating replacement access, substantial grading and/or installing additional culverts	4wd truck, bulldozer, grader, excavator, material truck	As needed/Days to weeks

[8] Note: these are common examples; actual equipment, activities, frequency, and duration will vary by utility and project.

Most major activities involve grading, excavation or disturbing soils, and vegetation removal or crushing. These actions are expected to require site-specific environmental analysis and compliance with established permitting processes. Reclamation would be conducted to reseed and recontour, if applicable, temporarily disturbed areas.

6.2.3. Emergency Maintenance Activities

An emergency situation is a condition or situation that is imminently likely to endanger life or property or that is imminently likely to cause a material adverse effect on security of, or damage to a utility's electrical system and/or flow of electricity. Emergency maintenance activities are those activities necessary to promptly restore electrical service or repair damage caused by natural hazards, weather, fire, problem nests, or human actions to a line or structures. These activities include the need to repair a power line or prevent additional damage to a line that would eliminate a human health or safety hazard and prevent damage to property or resources in the event of an outage. The equipment necessary to carry out response to outages or emergency repairs is generally similar to that used to conduct routine maintenance. At times, emergency responses may require additional equipment to complete the repairs.

The implementation of routine operation and maintenance activities on power lines will minimize the need for most emergency repairs. In the event of an emergency, a utility must respond as quickly as possible to restore power and may be required to take actions beyond those authorized in its ROW grant/special use permit/easement agreement. This may include construction of new access routes or reworking access roads without prior agency review or approvals. In most cases, notification to a land manager or resource agency of the emergency and actions taken will be done in concurrence with the utility responding to the emergency. Reasonable efforts should be taken during emergency response to reduce potential impacts to sage-grouse or their habitat. The utility and resource agencies should work together to identify and implement appropriate restoration or remedial measures after the emergency has been addressed.

7.0 Utility Best Management Practices in Sage-grouse Areas

Best management practices are specific means, measures, and practices that reduce or eliminate the detrimental effects of a proposed action. These measures, in some cases, are sufficient for meeting environmental policy and regulatory requirements. In some cases, additional formal and specific mitigation may be required to offset negative project impacts and ensure compliance with local, state, or federal regulations.

Resource agencies request or require that utilities first avoid sage-grouse habitat, and minimize impacts if they cannot be entirely avoided, and lastly, compensate for impacts that cannot be avoided or minimized. The Department of the Interior (DOI) recommends a hierarchical approach to mitigation, in which, "the term 'mitigation' encompasses the full suite of activities to avoid, minimize, and compensate for adverse impacts to particular resources or values" (Clement et al. 2014). Implementation of BMPs is an accepted method to minimize unavoidable impacts. APLIC and its agency partners have prepared this section to assist electric utilities in the identification and implementation of BMPs for avoiding and minimizing impacts to sage-grouse and their habitats during early stages of project planning through project construction and long-term maintenance activities for new and existing power line projects and their associated features in sage-grouse habitat.

The BMPs summarized below (Figure 7) are a list of voluntary environmental protection measures that can be included into a utility's project design and operational and maintenance programs for new and existing projects to avoid and/or minimize impacts to sage-grouse and their habitats. A utility may choose to incorporate applicable BMPs into the utility's existing Avian Protection Plan (APP) or other internal environmental guidance documents, or (for new projects) into project-specific bird conservation plans. Applicable BMPs can also be incorporated into a request for the re-authorization or upgrading of existing facilities on state, federal, and tribal lands.

This list of BMPs is intended to provide measures and guidance that will assist to conserve sage-grouse and their habitat. These BMPs can be applied to the siting of new power lines and associated features as well as the operational and maintenance actions associated with existing and new transmission and distribution lines. These BMPs are intended to address the potential direct and indirect impacts to sage-grouse and their habitat for new and existing power line related features on the landscape within existing sage-grouse range. The Conservation Objectives Team (COT) Report (USFWS 2013) details threats to sage-grouse and their habitat. The authors of this BMP document used the COT report as a framework to identify potential threats associated with electric utility infrastructure and developed specific BMPs targeted toward minimizing those identified potential threats.

The intent of the BMP list is not to have every BMP included with every project; rather, it is a menu that utilities can select from depending on the unique circumstances of their project. There may be projects where BMPs are not necessary. The BMP document can also be used as a reference for agencies to cite in their resource plans and permitting documents, particularly since the BMP document may be updated more frequently than RMP's/LUPs. Because this BMP document is intended to be updated as needed when new information is available, users are encouraged to check the APLIC website (ww.aplic.org) for the most current edition of the document.

Toolbox of Best Management Practices (BMPs) for electric utility activities in sage-grouse habitat. [9]

SITING and PLANNING: Best Management Practices

S-1. Avoid siting and construction of new power lines and associated features in priority habitat.

a. Obtain priority habitat (e.g. Priority Areas for Conservation (PACs), Preliminary Priority Habitat (PPH), Preliminary General Habitat (PGH), Proposed Priority Management Areas (PPMA), Proposed General Management Areas (PPMA), 'Connectivity', 'Core' habitat and analogous) boundaries/delineations to aid in siting or constructing new power lines outside of designated habitat(s).

i. Consult federal land management plans (e.g. BLM RMP, USFS LUP) and state sage-grouse conservation plans and/or strategies for existing boundaries/delineations of priority habitats.

b. Obtain lek location data from state and/or federal agencies to aid in siting of new power lines or construction activities.

i. Obtain current data from state and/or federal agencies that verifies the status of known sage-grouse leks. Leks will be assumed 'active' if lek surveys are not conducted during that year to establish 'inactivity'. Consult with local state sage-grouse conservation plans and/or strategies for their definitions of "active" and "inactive" leks. If no definitions are available, use definitions described in Connelly et al. (2000).

c. Consult state wildlife agency for known or available mapped seasonal habitat. Incorporate seasonal habitat (breeding/nesting, brood-rearing, winter) into project routing and planning.

i. Include designated Winter Concentration Areas (WCA) identified by state and/or federal agencies.

ii. Include known/identified migratory corridors/routes identified by state and/or federal agencies.

d. Develop and implement a utility 'project checklist' as part of company's environmental protection measures. Use the 'project checklist' to identify sage-

[9]The BMPs contained herein offer a list of voluntary environmental protection measures that can be included into a utility's project design and operational and maintenance programs for new and existing projects to avoid and/or minimize impacts to sage-grouse and their habitats. The intent of the BMP list is not to have every BMP included with every project; rather, it is a menu that utilities can select from depending on the feasibility and unique circumstances of their project.

grouse habitat and key areas (e.g. leks) within project areas early on so that environmental considerations are included from the project's start.

S-2. Where priority sage-grouse habitat cannot be avoided, implement no-disturbance buffers around leks and nesting habitat during breeding/ nesting season. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for buffer distances in protected habitat. If more conservative buffers exist in federal or state plans, they would supersede the recommendations below. In the absence of state-specific recommendations or other land management agency seasonal restrictions, the following would be used:

a. Incorporate a no-disturbance buffer of 0.6 miles around sage-grouse leks during breeding/nesting season. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for specific local dates and times.

S-3. Identify and implement seasonal timing stipulations/restrictions for construction work. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for specific dates and times. In the absence of specific dates and times:

a. Avoid active leks from 6:00 p.m. through 8:00 a.m. during the breeding ('lekking') season.
b. Breeding ('lekking')/Nesting season: 1 March – 31 May.
c. Brood-rearing season: 15 May – 31 July.
d. Winter Concentration Areas (WCA) or identified winter range: 1 December – 28 February.

S-4. If facilities cannot completely avoid sage-grouse habitat, utilize micrositing to minimize impact to priority habitat use areas.

S-5. If sage-grouse habitat cannot be avoided, co-locate new structures within existing Rights-of-Way (ROW) corridors, site new power lines adjacent to existing linear infrastructure corridors, or as close as allowed by reliability and siting criteria (see Section 4.1.1.).

a. Where appropriate, site development within existing designated ROWs.
b. Apply the minimal allowed centerline-to-centerline "separation distance" between new features and existing features, and design new lines to accommodate additional capacity if possible.
c. If feasible, design new lines to minimize tower height or number of structures in priority habitat.
d. When planning to site new lines in high quality sage-grouse habitat, attempt to minimize any new impacts to sage-grouse by siting new power lines or infrastructure in previously designated corridors.

S-6. Where avoidance of impacts to priority habitat is not feasible, evaluate engineering, economic, and environmental feasibility and costs/benefits of burying distribution lines in priority habitat (determined on a case-by-case basis). Where feasible, economically justified, and beneficial to sage-grouse, bury distribution lines crossing priority habitat (see Appendix A for factors associated with burying of power lines).

S-7. Minimize disturbance/removal of vegetation beneficial to sage-grouse (e.g. sage brush, forbes, and native grasses) in priority habitat by:

a. Siting staging areas out of priority habitat and minimize size/footprint of staging areas.
b. Siting pulling locations outside of priority habitat.
c. Siting equipment storage outside of priority habitat.

d. Minimizing development of new access roads by utilizing existing roads.

e. Upgrading roads to the minimum extent necessary.

f. Managing project access roads to limit public use in priority habitats.

S-8. Comply with required and voluntary density disturbance caps in non-priority habitat (consult federal and state plans for existing disturbance caps).

a. Evaluate any existing power lines within project study area and associated features in sage-grouse priority habitats to determine if these features would impact density caps.

b. Do not exceed disturbance cap for new projects and associated features.

S-9. Build and maintain power lines using recommendations identified by the Avian Power Line Interaction Committee to minimize electrocution and collision risks to all protected avian species (APLIC 2006, 2012, or most recent APLIC guidelines).

a. Design new lines to minimize avian electrocution risk.
b. Site lines in areas outside of priority habitat and minimize crossing of riparian zones or water courses to reduce avian collision risk.
c. Install line markers where sage-grouse collisions with existing power lines have been documented.

S-10. Partner or conduct research to obtain information on sage-grouse and power line-related avoidance, collision, or predation issues. Disseminate new research, BMP effectiveness data, lessons learned, etc. to cooperators/partners to aid in the ongoing improvement and refinement of BMPs. Such research may include:

a. Investigation of power line related impacts on sage-grouse (see UWIN 2011 for research protocols).

b. Effectiveness monitoring of implemented BMPs.

S-11. Develop programs to educate the public and utility customers on the need for sage-grouse habitat conservation efforts, the reasons to implement sage-grouse BMPs on new power line projects, and explain the potential associated costs and timing restrictions to customers requesting new service or facilities.

S-12. Report conservation actions that provide benefits to sage-grouse and ameliorate threats to sage-grouse (identified in the COT Report) to the USFWS in the Conservation Efforts Database.

S-13. Develop and implement a utility project checklist as part of company’s environmental protection measures. Use checklist to identify sage-grouse habitat and key areas (e.g. leks) potentially within project O&M work areas early on so that environmental considerations are included in project’s O&M activities.

CONSTRUCTION: Best Management Practices

C-1. Avoid construction of new power lines and associated features in priority habitat.

a. Obtain priority habitat (e.g. Priority Areas for Conservation (PACs), Preliminary Priority Habitat (PPH), Preliminary General Habitat (PGH), Proposed Priority Management Areas (PPMA), Proposed General Management Areas (PPMA), 'Connectivity', 'Core' habitat and analogous) boundaries/delineations.

i. Consult federal land management plans (e.g. BLM RMP, USFS LUP) and state sage-grouse conservation plans and/or strategies for existing boundaries/delineations of priority habitats.

b. Obtain lek location data from state and/or federal agencies to aid in siting of new power lines or construction activities.

i. Obtain current data for state and/or federal agencies that verifies the status of known sage-grouse leks. Leks will be assumed 'active' if lek surveys are not conducted during that year to establish 'inactivity'. Consult with local state sage-grouse conservation plans and/or strategies for the definitions of "active" and "inactive" leks. If no definitions are available, use definitions described in Connelly et al. (2000).

c. Consult state wildlife agency for known or available mapped seasonal habitat. Incorporate seasonal habitat (breeding/nesting, brood-rearing, winter) into project routing and planning.

i. Include designated Winter Concentration Areas (WCA) identified by state and/or federal agencies.

ii. Include known/identified migratory corridors/routes identified by state and/or federal agencies.

C-2. Where priority sage-grouse habitat cannot be avoided, implement no-disturbance buffers around leks and nesting habitat during breeding/ nesting season. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for buffer distances in protected habitat. If more conservative buffers exist in federal or state plans, they would supersede the recommendations below. In the absence of state-specific recommendations or other land management agency seasonal restrictions, the following would be used:

a. Incorporate a no-disturbance buffer of 0.6 miles around sage-grouse leks during nesting/breeding season. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for specific local dates and times.

C-3. Identify and implement seasonal timing stipulations/restrictions for construction work. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for specific dates and times. In the absence of specific dates and times:

a. Avoid active leks from 6:00 p.m. through 8:00 a.m. during the breeding ('lekking') season.

b. Breeding ('lekking')/Nesting season: 1 March – 31 May.

c. Brood-rearing season: 15 May – 31 July.

d. Winter Concentration Areas (WCA) or identified winter range: 1 December – 28 February.

C-4. Projects with the potential to disturb sage-grouse should be implemented in the least amount of time or during specified periods least likely to impact sage-grouse (while maintaining safe working practices).

C-5. Where avoidance of impacts to priority habitat is not feasible, evaluate engineering, economic, and environmental feasibility and costs/benefits of burying distribution lines in priority habitat (determined on a case-by-case basis). Where feasible, economically justified, and beneficial to sage-grouse, bury distribution lines crossing priority habitat (see Appendix A for factors associated with burying of power lines).

C-6. Build and maintain power lines using recommendations identified by the Avian Power Line Interaction Committee to minimize electrocution and collision risks to all protected avian species (APLIC 2006, 2012, or most recent APLIC guidelines).

a. Design new lines to minimize avian electrocution risk.
b. Site lines in areas outside of priority habitat and minimize crossing of riparian zones or water courses to reduce avian collision risk.
c. Install line markers where sage-grouse collisions with existing power lines have been documented.

C-7. Design and construct road crossings for ephemeral, intermittent, and perennial streams to minimize impacts to the riparian habitat, such as by crossing at right angles to ephemeral drainages and stream crossings. Work with local regulatory agencies regarding state plans for sage-grouse, wetlands, etc.

C-8. Design, upgrade, and maintain roads to an appropriate standard but no larger than necessary to accommodate their intended purposes. Construct roads with considerations for vehicle type (size, weight), and travel frequency, and with consideration of future public use in mind.

C-9. Conduct pre-construction weed surveys in areas before transmission line construction and implement conservation actions or pre-construction treatment to prevent and/or control noxious/invasive plant growth after reclamation efforts.

C-10. Vegetation removal should be limited to the minimum disturbance required by the project. Topsoil that is removed should be stored in temporary use areas for re-use during reclamation if soil does not contain evidence of invasive grasses or noxious weeds.

C-11. Use approved herbicides, where applicable and authorized, to control invasive/noxious weeds.

C-12. Minimize disturbance/removal of vegetation beneficial to sage-grouse (e.g. sage brush, forbes, and native grasses) in priority habitat by:

a. Siting staging areas out of priority habitat and minimize size/footprint of staging areas.
b. Siting pulling locations outside of priority habitat.
c. Siting equipment storage outside of priority habitat.
d. Minimizing development of new access roads by utilizing existing roads.
e. Upgrading roads to the minimum extent necessary.
f. Managing project access roads to limit public use in priority habitats.

C-13. In areas where off-road travel use is required and permitted, implement "drive and crush" methods for overland travel, when appropriate, instead of vegetation removal for construction of access roads. This will reduce the impact on vegetation in comparison to cutting/mowing.

a. Use temporary mats laid down in sensitive areas (e.g. wetlands, wet meadows, etc.) to prevent creation of tire ruts or vegetation damage.

C-14. Routinely inspect and wash vehicles and equipment to remove invasive or noxious weeds/plant materials, or seeds during construction activities.

a. Avoid off-road travel in areas of known noxious weed infestations to reduce the spread of invasive species to non-infested sites/areas.

C-15. Close exposed tower foundation holes at the end of the work day to prevent sage-grouse or other wildlife from falling in and becoming trapped.

C-16. Limit the number of vehicles on site to those necessary to perform, monitor, and inspect work. Keep construction vehicles within designated construction areas and ROW.

C-17. Limit motorized travel to designated construction areas, roads and trails. Comply with seasonal road/primitive road/trail restrictions when continued use may result in habitat degradations or other physical disturbances.

a. Consider seasonal closures outside of necessary utility access.
b. Where authorized and appropriate, gate and lock access roads to limit access to utility employees, agency personnel, and private land owners.

C-18. Establish speed limits on utility access roads crossing priority sage-grouse habitats. Place signage to indicate speed, and enforce speed limits for company employees and contractors.

a. Place “Wildlife Crossing” signage where applicable (e.g. near leks, brood-rearing habitat), to increase awareness of birds in the area and encourage safe and responsible speeds. This may reduce direct loss due to vehicle collision.

C-19. Contain, collect, and remove trash and construction debris regularly at construction sites and during maintenance activities to avoid attracting predators. Containers should have lids and trash removed as necessary to reduce overflow.

C-20. Properly manage, dispose, and remove slash piles as a result of construction or maintenance activities. Slash piles may increase fire fuel loads in the area as well as provide cover for predators.

C-21. Avoid activities that could result in new noise levels at the perimeter of a lek above 10 dBA from 6:00 p.m.to 8:00 a.m. during the breeding season (March 1 – May 31).

C-22. Establish and implement a fire prevention and suppression plan (consult and coordinate with local fire officials and rural fire districts). Adhere to seasonal fire restrictions and stipulations which may include:

a. Educate crews how to enforce and practice appropriate fire prevention actions and behavior.

b. Minimize idling during construction and routine maintenance activities.

c. Park vehicles in designated parking or construction areas. Avoid parking over tall, dry vegetation.

d. Implement use of spark arrestors.

e. Conduct routine vehicle inspections:

i. Increase inspection frequency during high fire dangers for build-up of flammable vegetation (and other materials) and remove.

ii. Confirm vehicles are equipped with designated fire suppression equipment.

f. Follow protocol for combustible materials storage, and develop appropriate fueling plan.

g. Clear flammable vegetation in work areas as appropriate before welding or related construction activities.

h. When welding in areas of high-risk fire danger, use a spotter.

i. Prohibit smoking or only smoke in designated areas.

j. Implement appropriate bird management practices (e.g. problem nest management, electrocution prevention) to reduce fire danger.

C-23. Reclaim ground/vegetation disturbances resulting from project-related construction activities and use local native seed mixes for restoration or re-vegetation efforts as approved by land owner/ manager.

a. Landowners should be encouraged to utilize native plant seed mix for re-vegetation efforts on private lands. Effort should be made to control noxious and invasive weed species, including cheatgrass and Japanese brome, that may occur after re-vegetation activities.

b. In certain instances, non-native vegetation (annual/sterile) may be used to prevent soil erosion, where a native understory will be ultimately established. Ensure no invasive species are used (consult with appropriate land management agency).

c. Reclamation efforts should attempt to re-establish native grasses, forbs, and shrubs to achieve cover, species composition, and life form diversity to benefit sage-grouse. Consult with local resource and land management agencies for appropriate seed mixes for individual project sites.

d. When reseeding temporary access roads, primitive roads, and trails, use seed mixes appropriate for vegetative conditions beneficial to sage-grouse and consider the use of transplanted sagebrush.

e. Restore construction disturbances to vegetation representative of healthy sagebrush ecosystems and functional sage-grouse habitat.

C-24. Utilize environmental compliance monitors required as part of project stipulations during construction activities to ensure environmental project stipulations and BMPs are implemented and followed.

C-25. In areas where corvid nesting and associated predation on sage-grouse nests and broods is a concern, consider methods to discourage nesting. This may include use of nest minimizing designs (e.g. monopoles, single crossarms, etc.) for new construction, or retrofitting existing structures where there is an identified problem nest.

a. Nest removal activities should be limited to those nests that pose a problem/risk (risk to birds or potential power outage), and as authorized by state and/or federal permits.

b. Removal of nest material may be necessary multiple times during nest building to discourage corvids (ravens) from nesting on power poles. Nest material removal may also be most effective when done in conjunction with other methods to discourage corvid nesting.

c. Migratory bird permits (e.g., utility SPUT permits) would typically authorize only the removal of inactive nests or active nests (excluding eagles and threatened/endangered species) that pose a safety, operational, or fire risk. Utilities should contact the USFWS and their state wildlife agency to determine if removal of an active corvid nest would be authorized.

d. See APLIC (2006) and www.aplic.org for additional information on nest management.

C-26. Implement recommendations identified by the Avian Power Line Interaction Committee to minimize electrocution and collision risks (APLIC 2006, 2012, or most recent APLIC guidelines) and reduce fire danger.

OPERATIONS and MAINTENANCE: Best Management Practices

O&M-1. Avoid impacts to sage-grouse and their associated priority habitats related to operations and maintenance (O&M) activities by identifying designated habitat where existing lines are located and scheduled maintenance activities will occur.

a. Obtain priority habitat (e.g. Priority Areas for Conservation (PACs), Preliminary Priority Habitat (PPH), Preliminary General Habitat (PGH), Proposed Priority Management Areas (PPMA), Proposed General Management Areas (PPMA), 'Connectivity', 'Core' habitat and analogous) boundaries/delineations.

   i. Consult federal land management plans (e.g. BLM RMP, USFS LUP) and state sage-grouse conservation plans and/or strategies for existing boundaries/delineations of priority habitats.

b. Obtain lek location data from state and/or federal agencies to aid in siting of new power lines or construction activities.

   i. Obtain current data for state and/or federal agencies that verifies the status of known sage-grouse leks. Leks will be assumed 'active' if lek surveys are not conducted during that year to establish 'inactivity'. Consult with local state sage-grouse conservation plans and/or strategies for the definitions of "active" and "inactive" leks. If no definitions are available, use definitions described in Connelly et al. (2000).

c. Consult state wildlife agency for known or available mapped seasonal habitat. Incorporate seasonal habitat (breeding/nesting, brood-rearing, winter) into project planning.

   i. Include designated Winter Concentration Areas (WCA) identified by state and/or federal agencies.

   ii. Include known/identified migratory corridors/routes identified by state and/or federal agencies.

O&M-2. Where priority sage-grouse habitat cannot be avoided, implement no-disturbance buffers around leks and nesting habitat during breeding/nesting season for non-emergency work. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for buffer distances in protected habitat. If more conservative buffers exist in federal or state plans, they would supersede the recommendations below. In the absence of state-specific recommendations or other land management agency seasonal restrictions, the following would be used:

a. Incorporate a no-disturbance buffer of 0.6 miles around sage-grouse leks during breeding/nesting season for non-emergency work. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for specific local dates and times.

O&M-3. Identify and implement seasonal timing stipulations/restrictions for non-emergency O&M work. Consult federal land use plans and state sage-grouse conservation plans and/or strategies for specific dates and times. In the absence of specific dates and times:

a. Avoid active leks from 6:00 p.m. through 8:00 a.m. during the breeding ('lekking') season.

b. Breeding ('lekking')/Nesting season: 1 March – 31 May.

c. Brood-rearing season: 15 May – 31 July.

d. Winter Concentration Areas (WCA) or identified winter range: 1 December – 28 February.

O&M-4. Projects with the potential to disturb sage-grouse should be implemented in the least amount of time or during specified periods least likely to impact sage-grouse (while maintaining safe working practices).

O&M-5. Establish and implement a fire prevention and suppression plan (consult and coordinate with local fire officials and rural fire districts). Adhere to seasonal fire restrictions and stipulations which may include:

a. Educate crews how to enforce and practice appropriate fire prevention actions and behavior.

b. Minimize idling during construction and routine maintenance activities.

c. Park vehicles in designated parking or construction areas. Avoid parking over tall, dry vegetation.

d. Implement use of spark arrestors.

e. Conduct routine vehicle inspections:

i. Increase inspection frequency during high fire dangers for build-up of flammable vegetation (and other materials) and remove.
ii. Confirm vehicles are equipped with designated fire suppression equipment.

f. Follow protocol for combustible materials storage, and develop appropriate fueling plan.

g. Clear flammable vegetation in work areas as appropriate before welding or related construction activities.

h. When welding in areas of high-risk fire danger, use a spotter.

i. Prohibit smoking or only smoke in designated areas.

j. Implement appropriate bird management practices (e.g. problem nest management, electrocution prevention) to reduce fire danger.

O&M-6. Implement recommendations identified by the Avian Power Line Interaction Committee to minimize electrocution and collision risks (APLIC 2006, 2012, or most recent APLIC guidelines) and reduce fire danger.

O&M-7. Avoid activities that could result in new noise levels at the perimeter of a lek above 10 dBA from 6:00 p.m.to 8:00 a.m. during the breeding season (March 1 – May 31).

O&M-8. Properly manage, dispose, and remove slash piles as a result of construction or maintenance activities. Slash piles may increase fire fuel loads in the area as well as provide cover for predators.

O&M-9. Comply with project invasive/weed management plan or other company-wide vegetation management plans.

O&M-10. Reclaim ground/vegetation disturbances resulting from project-related construction activities and use local native seed mixes for restoration or re-vegetation efforts as approved by land owner/ manager.

a. Landowners should be encouraged to utilize native plant seed mix for re-vegetation efforts on private lands. Effort should be made to control noxious and invasive weed species, including cheatgrass and Japanese brome, that may occur after re-vegetation activities.

b. In certain instances, non-native vegetation (annual/sterile) may be used to prevent soil erosion, where a native understory will be ultimately established. Ensure no invasive species are used (consult with appropriate land management agency).

c. Reclamation efforts should attempt to re-establish native grasses, forbs, and shrubs to achieve cover, species composition, and life form diversity to benefit sage-grouse. Consult with local resource and land management agencies for appropriate seed mixes for individual project sites.

d. When reseeding temporary access roads, primitive roads, and trails, use seed mixes appropriate for vegetative conditions beneficial to sage-grouse and consider the use of transplanted sagebrush.

e. Restore construction disturbances to vegetation representative of healthy sagebrush ecosystems and functional sage-grouse habitat.

O&M-11. In areas where off-road travel use is required and permitted, implement “drive and crush” methods for overland travel, when appropriate, instead of vegetation removal for construction of access roads. This will reduce the impact on vegetation in comparison to cutting/mowing.

a. Use temporary mats laid down in sensitive areas (e.g. wetlands, wet meadows, etc.) to prevent creation of tire ruts or vegetation damage.

O&M-12. Routinely inspect and wash vehicles and equipment to remove invasive or noxious weeds/plant materials, or seeds during construction activities.

a. Avoid off-road travel in areas of known noxious weed infestations to reduce the spread of invasive species to non-infested sites/areas.

O&M-13. Establish speed limits on utility access roads crossing priority sage-grouse habitats. Place signage to indicate speed, and enforce speed limits for company employees and contractors.

a. Place "Wildlife Crossing" signage where applicable (e.g. near leks, brood-rearing habitat), to increase awareness of birds in the area and encourage safe and responsible speeds. This may reduce direct loss due to vehicle collision.

O&M-14. Close exposed tower foundation holes at the end of the work day to prevent sage-grouse or other wildlife from falling in and becoming trapped.

O&M-15. Limit the number of vehicles on site to those necessary to perform, monitor, and inspect work. Keep construction vehicles within ROW.

O&M-16. Limit motorized travel to designated work areas, roads and trails. Comply with seasonal road/primitive road/trail restrictions when continued use would result in habitat degradations or other physical disturbances.

a. Consider seasonal closures outside of necessary utility access.

b. Where authorized and appropriate, gate and lock access roads to limit access to utility employees, agency personnel, and private land owners.

O&M-17. In areas where corvid nesting and associated predation on sage-grouse nests and broods is a concern, consider methods to discourage nesting. This may include use of nest minimizing designs (e.g. monopoles, single crossarms, etc.) for new construction, or retrofitting existing structures where there is an identified problem nest.

a. Nest removal activities should be limited to those nests that pose a problem/risk (risk to birds or potential power outage), and as authorized by state and/or federal permits.

b. Removal of nest material may be necessary multiple times during nest building to discourage corvids (ravens) from nesting on power poles. Nest material removal may also be most effective when done in conjunction with other methods to discourage corvid nesting.

c. Migratory bird permits (e.g., utility SPUT permits) would typically authorize only the removal of inactive nests or active nests (excluding eagles and threatened/endangered species) that pose a safety, operational, or fire risk. Utilities should contact the USFWS and their state wildlife agency to determine if removal of an active corvid nest would be authorized.

d. See APLIC (2006) and www.aplic.org for additional information on nest management.

O&M-18. Remove pinyon pine or juniper trees that exist in the ROW. This may reduce trees growing into lines and associated risk of fire, and hinder conifer encroachment.

REMOVAL, RECLAMATION, RESTORATION: Best Management Practices

R-1. Comply with required and voluntary density disturbance caps in non-priority habitat (consult federal and state plans for existing disturbance caps).

a. Evaluate any existing power lines within project study area and associated features in sage-grouse priority habitats to determine if these features would impact density caps.

b. Do not exceed disturbance cap for new projects and associated features.

R-2. Remove abandoned utility access roads and reclaim to pre-disturbance or adjacent habitat conditions.

a. Establish reclamation standards which should include restoring reclaimed areas to vegetation representative of healthy sagebrush ecosystems and functional sage-grouse habitat.

R-3. Remove abandoned utility infrastructure and reclaim to pre-disturbance or adjacent habitat conditions.

a. Establish reclamation standards which should include restoring reclaimed areas to vegetation representative of healthy sagebrush ecosystems and functional sage-grouse habitat.

Figure 7. Summary of Best Management Practices[10] and associated threats[11].

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Siting BMPs									
Siting	S-1	Avoid siting and construction of new power lines and associated features in priority habitat.	x	x			x		
Siting	S-2	Where priority sage-grouse habitat cannot be avoided, implement no-disturbance buffers around leks and nesting habitat during breeding/nesting season.	x	x					
Siting	S-3	Identify and implement seasonal timing stipulations/restrictions for construction work.	x	x					
Siting	S-4	If facilities cannot completely avoid sage-grouse habitat, utilize micrositing to minimize impact to priority habitat use areas.		x			x		

[10] The BMPs contained herein offer a list of voluntary environmental protection measures that can be included into a utility's project design and operational and maintenance programs for new and existing projects to avoid and/or minimize impacts to sage-grouse and their habitats. The intent of the BMP list is not to have every BMP included with every project; rather, it is a menu that utilities can select from depending on the feasibility and unique circumstances of their project.

[11] Threats identified in the Conservation Objectives Team (COT) Report (USFWS 2013). While predation is not a threat to species' persistence, conservation actions that reduce the presence of predators may provide a benefit to population demographics. Check marks in each of the threat columns indicate that the associated BMPs are targeted at addressing or minimizing these threats.

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Siting	S-5	If sage grouse habitat cannot be avoided, co-locate new structures within existing ROW corridors, site new power lines adjacent to existing linear infrastructure corridors, or as close as allowed by reliability and siting criteria (see Section 4.1.1.)		x			x		
Siting	S-6	Evaluate engineering, economic, and environmental feasibility and costs/benefits of burying distribution lines in priority habitat (case-by-case basis).		x			x		
Siting	S-7	Minimize vegetation disturbance/removal in priority habitat.		x					
Siting	S-8	Comply with required and voluntary density disturbance caps in non-priority habitat (consult federal and state plans for existing disturbance caps).	x	x			x		
Siting	S-9	Build and maintain power lines using recommendations identified by APLIC to minimize electrocution and collision risks to all protected avian species.	x				x		

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Siting	S-10	Partner or conduct research to obtain information on sage-grouse and power line-related avoidance, collision or predation issues. Disseminate new research, BMP effectiveness data, lessons learned, etc. to cooperators/partners to aid in the ongoing improvement of BMPs.	x				x		
Siting	S-11	Develop programs to educate the public and utility customers on need for sage-grouse habitat conservation efforts, reasons to implement sage-grouse BMPs on new power line projects, and potential costs/timing restrictions.	x	x					
Siting	S-12	Report conservation actions that provide benefits to sage-grouse and ameliorate threats to the USFWS in the Conservation Efforts Database.	x						
Siting	S-13	Develop and implement a utility project checklist as part of company's environmental protection measures.	X				X		

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Construction BMPs									
Construction	C-1	Avoid construction of new power lines and associated features in priority habitat.	x	x			x		
Construction	C-2	Where priority sage-grouse habitat cannot be avoided, implement no-disturbance buffers around leks and nesting habitat during breeding/nesting season.	x	x					
Construction	C-3	Identify and implement seasonal timing stipulations/restrictions for construction work.	x	x					
Construction	C-4	Projects with the potential to disturb sage-grouse should be implemented in the least amount of time or during specified periods least likely to impact sage-grouse (while maintaining safe working practices).	x						
Construction	C-5	Evaluate engineering, economic, and environmental feasibility and costs/benefits of burying distribution lines in priority habitat (case-by-case basis).		x			x		

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Construction	C-6	Build and maintain power lines using recommendations identified by APLIC to minimize electrocution and collision risks to all protected avian species.					x		
Construction	C-7	Design and construct road crossings for ephemeral, intermittent, and perennial streams to minimize impacts to riparian habitats.		x			x		
Construction	C-8	Design, upgrade, and maintain roads to an appropriate standard no larger than necessary to accommodate their intended purposes.		x			x		
Construction	C-9	Conduct pre-construction weed surveys in areas before transmission line construction and implement actions to prevent/control noxious/invasive plant growth after reclamation efforts.		x	x				
Construction	C-10	Vegetation removal should be limited to the minimum disturbance required by the project. Topsoil that is removed should be stored in temporary use areas for re-use.		x	x				

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Construction	C-11	Use approved herbicides, where applicable and authorized, to control invasive/noxious weeds.		x	x				
Construction	C-12	Minimize disturbance/removal of beneficial vegetation in priority habitat.		x	x				
Construction	C-13	Where off road travel use is required and permitted, implement "drive and crush" methods for overland travel instead of vegetation removal for construction of access roads.		x			x		
Construction	C-14	Inspect and wash vehicles and equipment to remove invasive or noxious weeds/plant materials or seeds.			x				
Construction	C-15	Close exposed tower foundation holes at the end of the work day to prevent sage-grouse or other wildlife from falling in and becoming trapped.	x						
Construction	C-16	Limit the number of vehicles on site to those necessary to perform, monitor, and inspect work. Keep construction vehicles within designated construction areas and ROW.	x	x					

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats						
			Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Construction	C-17	Limit motorized travel to designated construction areas, roads and trails. Comply with seasonal road/primitive road/trail access and use restrictions.	x	x					
Construction	C-18	Establish speed limits on utility access roads crossing priority sage-grouse habitats.	x						
Construction	C-19	Contain, collect, and remove trash and construction debris regularly at construction sites and during maintenance activities to avoid attracting predators.				x			
Construction	C-20	Properly manage, dispose, and remove slash piles associated with construction or maintenance activities.				x		x	
Construction	C-21	Avoid activities that could result in new noise levels at the perimeter of a lek above 10 dBA from 6:00 p.m.to 8:00 a.m. during the breeding season.	x						

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Construction	C-22	Establish and implement a fire prevention and suppression plan (consult and coordinate with local fire officials and rural fire districts) and adhere to seasonal fire restrictions and stipulations.						x	
Construction	C-23	Reclaim ground/vegetation disturbances resulting from project-related construction activities and use local native seed mixes for restoration or re-vegetation efforts when approved by landowner or land manager.	x	x	x		x		
Construction	C-24	Utilize environmental compliance monitors during construction activities to ensure environmental project stipulation and BMPs are implemented and followed.	x						
Construction	C-25	In areas where corvid nesting and associated predation on sage-grouse nests and broods is a concern, consider methods to discourage nesting.				x	x		
Construction	C-26	Implement recommendations identified by APLIC to minimize electrocution and collision risks and reduce fire danger.					x	x	

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Operations and Maintenance BMPs									
O & M	O&M -1	Avoid impacts to sage-grouse and their associated priority habitats related to operations and maintenance (O&M) activities.	x	x					
O & M	O&M -2	Where priority sage-grouse habitat cannot be avoided, implement no-disturbance buffers around leks and nesting habitat during breeding/ nesting season.	x	x					
O & M	O&M -3	Identify and implement seasonal timing stipulations/restrictions for non-emergency O&M work.	x	x					
O & M	O&M -4	Projects with the potential to disturb sage-grouse should be implemented in the least amount of time or during specified periods least likely to impact sage grouse (while maintaining safe work practices).	x	x					

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
O & M	O&M -5	Establish and implement a fire prevention and suppression plan (consult and coordinate with local fire officials and rural fire districts) and adhere to seasonal fire restrictions and stipulations.						x	
O & M	O&M -6	Build and maintain power lines using recommendations identified by APLIC to minimize electrocution and collision risks to all protected avian species.					x	x	
O & M	O&M -7	Avoid activities that could result in new noise levels at the perimeter of a lek above 10 dBA from 6:00 p.m.to 8:00 a.m. during the breeding season.	x						
O & M	O&M -8	Properly manage, dispose, and remove slash piles as a result of maintenance activities.				x		x	
O & M	O&M -9	Comply with project invasive/weed management plan or other company-wide vegetation management plans.			x				x

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats						
			Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
O & M	O&M -10	Reclaim ground/vegetation disturbances from project related O&M and use local native seed mixes for restoration or re-vegetation efforts when approved by land owner manager.		x	x				
O & M	O&M -11	Where off road travel use is required and permitted, implement "drive and crush" methods for overland travel instead of vegetation removal for construction of access roads.		x			x		
O & M	O&M -12	Inspect and wash vehicles and equipment to remove invasive or noxious weeds/plant materials or seeds.			x				
O & M	O&M -13	Establish speed limits on utility access roads crossing priority sage-grouse habitats.	x						
O & M	O&M -14	Close exposed tower foundation holes at the end of the work day to prevent sage-grouse or other wildlife from falling in and becoming trapped.	x						

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
O & M	O&M -15	Limit the number of vehicles on site to those necessary to perform, monitor, and inspect work. Keep construction vehicles within the ROW.	x						
O & M	O&M -16	Limit motorized travel to designated work areas, roads and trails. Comply with seasonal road/primitive road/trail restrictions.	x	x	x				
O & M	O&M -17	In areas where corvid nesting and associated predation on sage-grouse nests and broods is a concern, consider methods to discourage nesting.				x	x		
O & M	O&M -18	Remove conifer trees in the ROW to minimize fire risks and hinder conifer encroachment.						x	x
Restoration									
Restoration	R-1	Comply with required and voluntary density disturbance caps in non-priority habitat (consult federal and state plans for existing disturbance caps).	x				x		
Restoration	R-2	Remove abandoned utility access roads and reclaim to pre-disturbance or adjacent habitat conditions.		x			x		

Activity Type	BMP No.	Abbreviated BMP Description	Identified Threats: Energy Development	Sagebrush Elimination	Noxious Weeds/Annual Grasses	Predation	Infrastructure	Fire	Conifer Encroachment
Restoration	R-3	Remove abandoned utility infrastructure and reclaim to pre-disturbance or adjacent habitat conditions.		x			x		

8.0 Mitigation Toolbox

Despite the use of BMPs to avoid and minimize impacts to sage-grouse and their habitat during new project construction and long term O&M activities, compensatory mitigation may be required to offset unavoidable impacts (direct and/or indirect). The following is a "mitigation toolbox" of potential projects or efforts that could be used for mitigation. Utilities with projects requiring mitigation (e.g., new construction of major transmission lines in sage-grouse habitats) should work with state and federal agencies to determine mitigation types, amounts, and locations appropriate to project-specific impacts[12].

Since power lines and their associated features would likely be on the landscape for decades or longer, mitigation for unavoidable direct and indirect impacts should be designed to ensure the following life-of-project effects considerations:

1. Landscape Planning

   A mitigation program should be developed in conjunction with, or guided by, a landscape-level conservation plan to ensure the viability of the species and the ecosystem upon which it depends over time.

2. Mitigation Hierarchy

   New activities should be designed, sited, and implemented to adhere to the basic hierarchy of avoidance, minimization, rehabilitation, and compensatory mitigation (also referred to as "offset") as guided by a conservation/mitigation strategy.

3. Location

   Compensatory mitigation actions should be sited in locations that have been identified in conservation strategies to most benefit from the types of conservation actions targeted in the mitigation program.

4. Additionality

   Actions proposed as mitigation must provide benefits beyond those that would be achieved anyway under applicable regulations and/or land-use management plans.

5. Effectiveness

   Actions should be measurable and proven to be reasonably likely to deliver expected conservation benefits. Monitoring and adaptive management will be important components to ensure success.

[12] The BLM's Regional Mitigation Manual provides guidance for mitigation of projects on BLM lands (see http://www.blm.gov/wo/st/en/info/mitigation.html).

6. Timeliness

   Mitigation actions should achieve targeted biological conditions in a timeframe commensurate with the life of the associated biological impacts.

7. Durability

   Actions or plans proposed as mitigation should be accompanied by appropriate legal and financial assurances.

8. Metrics

   Determining the expected impacts of actions and the measures necessary to avoid, minimize, restore and/or offset those impacts should be based solely on biological conditions/information and upon reliable and repeatable methods.

9. Species Benefit

   Including mitigation, overall outcomes should result in no net loss to the species; a net benefit will assure overall net conservation status improvement and assist in precluding the need to list the species.

Mitigation actions should be identified in conjunction with state and federal wildlife agencies and take into consideration any regional mitigation strategies that have been developed.

Examples of mitigation action include, but are not limited to the following:

- Conservation easements that protect sage-grouse habitat from future development and/or implement management practices (e.g., grazing strategies) to enhance habitat.
- Purchase, restoration, and/or preservation of habitat that support sage-grouse populations or provides key linkages between populations.
- Removal of conifers to re-establish sagebrush communities in areas identified by agencies as a priority.
- Marking or removal of fences in high risk areas for sage-grouse collision risk..
- Protection and/or restoration of wet meadows to create or improve brood rearing habitat.
- Restoration of sage-grouse habitats impacted by fire.
- Research and testing of safe and effective methods to reduce raven use of structures.
- Research and testing of techniques to enhance sagebrush survivorship, such as genetically modified sagebrush seeds to increase growth (where genetic modification does not result in negative, unintended consequences).

- Research and testing of methods to control cheat grass.
- Research on sage-grouse/power line impacts using the UWIN (2011) tall structure protocols.

9.0 State and Federal Agency Sage-grouse Plans

State and federal resource agencies have developed or are developing specific plans for sage-grouse management, or including sage-grouse conservation objectives in agency planning documents (e.g., FMPs, RMPs, etc.). Below is a list of agencies and their sage-grouse website links. Utilities and other users of this BMP document are encouraged to review state and federal agency planning documents that may contain stipulations, guidance, and site-specific information for sage-grouse in their area.

State Agency Plans

- California Department of Fish and Wildlife: http://www.dfg.ca.gov/regions/6/Conservation/Sage_Grouse.html
- Colorado Parks and Wildlife: http://cpw.state.co.us/learn/Pages/GreaterSagegrouseConservationPlan.aspx
- Idaho Department of Fish and Game: http://fishandgame.idaho.gov/public/wildlife/sagegrouse/
- Montana Fish, Wildlife, and Parks: http://fwp.mt.gov/fishAndWildlife/management/sageGrouse/
- Nevada Department of Wildlife: http://www.ndow.org/Nevada_Wildlife/Sage_Grouse/
- North Dakota Game and Fish Department: http://www.gf.nd.gov/conservation-nongame-wildlife/sage-grouse-management-plan
- Oregon Department of Fish and Wildlife: http://www.dfw.state.or.us/wildlife/sagegrouse/
- South Dakota Game, Fish, and Parks: http://gfp.sd.gov/hunting/small-game/sage-grouse-management.aspx
- Utah Division of Wildlife Resources: http://wildlife.utah.gov/uplandgame/sage-grouse/
- Washington Department of Fish and Wildlife: http://wdfw.wa.gov/publications/01317/
- Wyoming Game and Fish Department: http://wgfd.wyo.gov/web2011/wildlife-1000382.aspx

Federal Agency Plans/Documents

- Bureau of Land Management: http://www.blm.gov/wo/st/en/prog/more/sagegrouse.html
- Natural Resources Conservation Service: http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/null/?cid=steldevb1027671

- U.S. Fish and Wildlife Service: http://www.fws.gov/mountain-prairie/species/birds/sagegrouse/

- U.S. Forest Service: http://www.fs.fed.us/research/wildlife-fish/themes/sage_grouse.php

- Environment Canada: http://www.ec.gc.ca/default.asp?lang=En&n=714D9AAE-1&news=8B997117-90A0-44DF-B62C-78E65A6419A4

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11.0 List of Acronyms

ANSI	American National Standards Institute
APLIC	Avian Power Line Interaction Committee
APP	Avian Protection Plan
ATV	All-Terrain Vehicle
BACI	Before-After-Control-Impact
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BMP	Best Management Practice
CEQ	Council on Environmental Quality
COT	Conservation Objectives Team
EEI	Edison Electric Institute
EOC	Executive Oversight Committee (WAFWA)
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FLPMA	Federal Land Policy and Management Act
GIS	Geographic Information Systems
IVM	Integrated Vegetation Management
LUP	Land Use Plan
MBTA	Migratory Bird Treaty Act
MRO	Midwest Reliability Organization
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NGO	Non-governmental organization
NMFS	National Marine Fisheries Service
NRECA	National Rural Electric Cooperative Association
OSHA	Occupation Safety and Health Administration
PAC	Priority Areas for Conservation
PPH	Preliminary Priority Habitat
RISCT	Range-wide Interagency Sage-grouse Conservation Team
RMP	Resource Management Plan
ROW	Rights-of-way
RUS	Rural Utilities Service
SPUT	Special Purpose Utility (Permit)
UDWR	Utah Division of Wildlife Resources
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
UWIN	Utah Wildlife in Need

VMP	Vegetation Management Program
WAFWA	Western Association of Fish and Wildlife Agencies
WECC	Western Electricity Coordinating Council

12.0 Glossary

Avian Protection Plan (APP)

An APP is a utility-specific program to reduce the operational and avian risks that result from avian interactions with electric utility facilities.

Avian-safe

A power pole configuration designed to minimize avian electrocution risk by providing sufficient separation between phases and between phases and grounds to accommodate the wrist-to-wrist or

head-to-foot distance of a bird. If such separation cannot be provided, exposed parts are covered to reduce electrocution risk, or perch management is employed. This term has replaced the term "raptor-safe" used in the 1996 edition of APLIC's *Suggested Practices*.

Before-After-Control-Impact (BACI)

Observational studies conducted to determine potential impacts of variables. Data is collected both before and after the response variable, and at both control and treatment (impact) study sites.

Boarder zone

An area on an electric utility right-of-way outside the wire zone, extending to the outer edge of the established right-of-way. Applies to electric utility rights-of-way only.

Circuit (single)

A conductor or system of conductors through which an electric current is intended to flow. The circuit is energized at a specified voltage.

Circuit (multiple)

A configuration that supports more than one circuit.

Co-location

Siting new infrastructure adjacent to or near existing infrastructure. For example, new power lines may be co-located with existing power lines, roads, or pipelines where feasible.

Conductor

The material (usually copper or aluminum)—usually in the form of a wire, cable or bus bar—suitable for carrying an electric current.

Configuration

The arrangement of parts or equipment on a utility structure. A distribution configuration would include the necessary arrangement of crossarms, braces, insulators, etc. to support one or more electrical circuits.

Construction staging area

Designated areas used temporarily to position vehicles, supplies, and equipment for access and use during power line construction.

Core area

Areas containing priority habitats for sage-grouse that represent high population abundance for the species' known breeding populations. This term is used specifically by certain states and not used as a range-wide designation.

Corvid

Birds belonging to the family Corvidae; includes crows, ravens, magpies, and jays.

Crossarm

A horizontal supporting member used to support electrical conductors and equipment for the purpose of distributing electrical energy. Can be made of wood, fiberglass, concrete, or steel, and manufactured in various lengths.

dBA

A-weighted decibels. A measure of environmental noise.

Density disturbance cap

A maximum threshold of anthropogenic disturbance allowed within a given area. State sage-grouse management plans may include density disturbance caps or thresholds beyond which no new anthropogenic development is allowed.

Distribution line

A circuit of low-voltage wires, energized at voltages from 2.4 kV to 60 kV, and used to distribute electricity to residential, industrial and commercial customers.

Energized

Any electrical conducting device connected to any source of electricity.

Facility

As used in this manual, this term refers to all the equipment, wires, structures (e.g., poles and towers), etc., that are involved in carrying electricity.

Fault

A power disturbance that interrupts the quality of electrical supply. A fault can have a variety of causes including fires, ice storms, lightning, animal electrocutions, or equipment failures.

Gallinaceous

Birds of the order Galliformes, which include grouse, quail, partridges, pheasants, ptarmigan, and turkeys. Sage-grouse are galliforms.

Generation plant

A facility that generates electricity.

Ground

An object that makes an electrical connection with the earth.

Ground rod

Normally a copper-clad steel rod or galvanized steel rod, driven into the ground so that ground wires can be physically connected to the ground potential.

Guy

Secures the upright position of a pole and offsets physical loads imposed by conductors, wind, ice, etc. Guys are normally attached to anchors that are securely placed in the ground to withstand loads within various limits.

Insulator

Nonconductive material in a form designed to support a conductor physically and to separate it electrically from another conductor or object. Insulators are normally made of porcelain or polymer.

Kilovolt

1000 volts, abbreviated kV.

Latticework

The combination of steel members connected together to make complete structures, such as transmission towers or substation structures.

Lek

An area where two or more strutting male birds attend the same location for two years or more; not necessarily consecutive years. Several gallinaceous bird species, including sage-grouse, use leks.

- *Active lek*: Based on a year-by-year review, a lek that has been attended by male sage-grouse during the annual strutting and breeding season.

- *Occupied lek*: A sage-grouse lek which has been active at least once within the last 10 years.

- *Inactive lek:* A lek that has not been attended by 2 or more males for 2 or more of the previous 5 years. The lek should be surveyed several (3 or more) times in 5 consecutive years to establish that the lek has truly been abandoned or inactive.

Load

Electricity demand for a given area.

Micrositing

The process of considering site-specific landscape features into route planning. Micrositing may be used to avoid sage-grouse leks, important habitats, or other sensitive features.

Mitigation

The full suite of activities to avoid, minimize, and compensate for adverse impacts to particular resources or values.

Monopole

A structure composed of a single pole or tower used to support conductors or other equipment.

Neutral conductor

A conductor or wire that is at ground potential, i.e., grounded.

Outage

Event that occurs when the energy source is cut off from the load.

Phase

An energized electrical conductor.

Phase-to-ground

The contact of an energized phase conductor to ground potential. A bird can cause a phase-to-ground fault when fleshy parts of its body touch an energized phase and ground simultaneously.

Phase-to-phase

The contact of two energized phase conductors. Birds can cause a phase-to-phase fault when the fleshy part of their wings or other body parts contact two energized phase conductors at the same time.

Pole

A vertical structure used to support electrical conductors and equipment for the purpose of distributing electrical energy. It can be made of wood, fiberglass, concrete, or steel, and manufactured in various heights.

Power line

A combination of conductors used to transmit or distribute electrical energy, normally supported by poles.

Preliminary General Habitat (PGH)

Areas of occupied seasonal or year-round habitat outside of PPH. These areas include Low Density Habitat, as well as additional areas of suitable sagebrush habitat. The BLM and USFS define PGH as habitat types of moderate importance, however, PGH may also include areas of higher quality habitat that lacks bird survey and inventory data to support a priority habitat ranking.

Preliminary Priority Habitat (PPH)

Essential, irreplaceable, and important sage-grouse habitats that include breeding habitat (lek sites and nesting habitat), brood-rearing habitat, winter range, and important movement corridors. The BLM and USFS define PPH as having the highest conservation value to maintaining sustainable sage-grouse populations.

Priority Areas for Conservation (PACs)

Term used in the USFWS 2013 COT Report to refer to the most important areas needed for maintaining sage-grouse representation, redundancy, and resilience across the landscape, as identified in state sage-grouse management plans. These areas were identified as highly important for long term viability of the species and a primary focus of conservation efforts.

Problem pole

A pole used by birds (usually for perching, nesting, or roosting) that has electrocuted birds or has a high electrocution risk.

Pulling location

Designated temporary use sites along a new power line construction corridor used to house conductor reels and pull conductors into insulators on overhead structures.

Reliability

The percentage of time a line is delivering uninterrupted electricity.

Reroute

The act of removing an existing line from the original right-of-way and rebuilding it along another route.

Retrofitting

The modification of an existing electrical power line structure to make it avian-safe.

Rights-of-way (ROW)

The strip of land that has been acquired by an agreement between two or more parties for the purpose of constructing and maintaining a utility easement. The width of right-of-way required by each voltage level is generally dictated by state statutes and the National Electrical Safety Code (NESC) and is a function of span length, the conductor height above ground, and the conductor's low point

of sag.

Route

The pathway on which a right-of-way will be acquired and the new line constructed.

Sag

The distance measured vertically from a conductor to the straight line joining its two points of support.

Separation

The physical distance between conductors and/or grounds from one another.

Siting

The process of identifying the points in the electrical system that need new lines of connection to deliver electricity to growing or new demand centers.

Span

The pole-to-pole or tower-to-tower distance of a power line.

Structure

A pole or lattice assembly that supports electrical equipment for the transmission or distribution of electricity.

Substation

A transitional point (where voltage is increased or decreased) in the transmission and distribution system.

Termination

Structure or facility where power line ends, or where line transitions from underground to overhead.

Transmission line

Power lines designed and constructed to support voltages >60 kV.

Utility corridor

The broad area between the origin and termination of a new line, within which the potential routes lie. The area in which a new line's routing alternatives are proposed and evaluated before the final route is determined.

Volt

The measure of electrical potential.

Voltage

Electromotive force expressed in volts.

Voltage rating

The voltage rating of a transmission line depends on the utility's existing transmission system voltages, interconnections with other utilities, potential delivery points, and the amount of power that must be transmitted to meet load requirements. As voltages increase, the amount of power that can be transmitted increases. Various line-design parameters such as conductor size and configuration, spacing, and the number of conductors per phase (bundling) allow for increased transmission capability. Transmission voltages for carrying energy long distances are generally in the 115 to 765 kV range in North America.

Winter concentration area

Location(s) containing high quality sage-grouse winter habitat where large concentrations of sage-grouse have been observed repeatedly over time.

Wire Zone

An area on an electric utility right-of-way directly beneath and between the energized conductors farthest out on the pole/tower. This area is the most likely to contain vegetation that could potentially grow into contact with the energized conductors. This area is also typically used as access to the poles, towers, and conductors for repair, inspection, and maintenance. Applies to electric utility rights-of-way only.

APPENDICES

Appendix A. Underground Power Lines and Perch Discouragers

Undergrounding power lines or installing perch discouragers are often raised as possible permit stipulations or mitigation options. However, both of these practices have efficacy, cost, and unintended environmental concerns that must be considered. Often, such risks outweigh the intended benefits of these practices. However, when no other options are available and construction of a power line in high quality sage-grouse habitat is proposed, undergrounding for discrete distances may be a viable alternative that can be evaluated. Undergrounding power lines and installing perch discouragers are not recommended as BMPs in certain circumstances and should only be used in limited applications where the associated risks/impacts are warranted. Below are details regarding the constraints associated with installing power lines underground and installing perch discouragers.

A.1 Underground Power Lines

Electric utilities install power lines either overhead or underground depending upon numerous considerations. Some key factors include customer needs, costs, code requirements, terrain, voltage, and technological and environmental restrictions. Cost is a major concern as electric utilities are dictated by public service commissions to serve customers with high quality, reliable electric service at the lowest cost possible. Undergrounding can contribute to longer outages and more expensive service that will affect customers. Terrain, habitat type, existing infrastructure or natural features, maintenance access, reliability and construction constraints or other factors are considerations that need to be evaluated prior to proposing to construct an underground line.

Power lines, particularly residential distribution lines (e.g., 35 kV and below), may be installed underground in newly developed areas, where it has been found feasible to do so. However, at transmission voltages (e.g., at 46 kV and above), installing lines underground is often not physically or financially feasible. Likewise, environmental concerns may preclude underground installation of power lines of both transmission and distribution voltages. In certain circumstances, however, undergrounding power lines may be a viable alternative, especially for distribution lines where high value sage-grouse habitat will be impacted and mitigation costs to offset those impacts may have significant influence on the cost-benefit analysis.

This section discusses engineering, environmental and financial considerations of undergrounding power lines.

A.1.a Engineering Considerations

<u>*Undergrounding construction process*</u>: For both the 230 kV and 500 kV voltage levels, the installation of underground transmission lines uses similar techniques. Large open trench installation or the more costly trenchless technologies are utilized to place the cables underground. Construction includes, but may not be limited to, clearing of the ROW, trenching, installation of duct banks or pipe networks, installation of vaults, cable splicing and terminating, and termination structure construction.

Trenching: Generally the most common technique for placing underground lines, open cut trenching utilizes a large surface excavation to install the required infrastructure. The typical trench dimensions vary by cable type, voltage level, and required power transfer, but in all cases require a minimum cover depth of 3 feet. While a number of cable arrangements can be achieved, soil characteristics and existing infrastructure often play the largest role of how the installations are designed. Trenching operations are typically staged such that a maximum of 300 to 500 feet of trench is open at any one time. Steel plating may be positioned over the open trench to minimize surface disruptions, while traffic controls can alleviate congestion through the project area. Emergency vehicle and local access must be coordinated with local jurisdictions as necessary.

Installation: Single- and double-circuit solid dielectric cable systems are often installed in duct bank configurations. Another method is duct burial.

Vault Installation: In a vault installation, preformed concrete splice vaults are placed at approximately 1,500- to 2,000-foot intervals depending on the maximum cable per reel length. The vaults, initially used to install the cables into the conduits, are primarily used to house the splice assemblies, and to provide access for inspections of the system. The vaults are used to sectionalize segments of cable in the event of a failure in order to locate the faulted cable and repair the required section. The typical installation time frame of each vault is approximately one week beginning with excavation, placement, compaction, and finally resurfacing of the excavated area.

Cable Pulling, Splicing, and Termination: Upon completion of the civil construction, cables are installed within the duct banks or steel pipes. Each cable segment is installed, spliced at each of the vaults along the route, and terminated at the transition sites where the cable connects to overhead conductors. To install the cable, a reel of cable is positioned at one end of a cable section, while a pulling rig is located at the other end. Using wire rope, each section of cable is installed into its respective conduit/steel pipe, while workers apply either water-based lubricant for solid dielectric cable or dielectric fluid for pipe type cable, to the cable jacket to minimize the frictional forces placed on the cables. Before termination or splicing operations begin, the cables are trained into the correct position using heat blankets. This process removes the curvature of the cable from being on the reel while also relieving any longitudinal strain exerted on the cable during pulling operations.

Termination Structure Construction: Overhead termination structures are required for underground lines. At 230 kV, either single structure transitions or larger transitions sites, resembling those of 500 kV lines, are required. Because of the large size of cable equipment required for 500 kV lines, large transition sites are the only option. For distribution voltages, termination structures can pose avian electrocution risks or provide nest substrates for raptors or ravens. Utilities should review the APLIC guidance for avian-safe riser pole designs (see http://www.aplic.org/riser-poles-wind.php).

Underground lines may require additional equipment to compensate for voltage changes along the length of the line. This limits the length of line that can be installed underground, particularly as voltages increase. In addition, additional equipment needed to regulate voltage increases overall costs and likelihood of failures due to additional components.

Operations, Maintenance, and Reliability: Underground power lines can be difficult to repair when the ground is frozen and access to underground facilities can be hampered by heavy snow, delaying outage response times. Underground power lines are susceptible to flooding and are still vulnerable to lightning damage to equipment. Underground power lines are vulnerable to dig-ins by those that may not follow proper procedures to identify underground facilities prior to excavation. Stray voltage concerns are increased with underground, versus, overhead lines. Underground lines are subject to joint failure, which can be difficult to locate and repair (Patrick Engineering 2010). While underground systems comparatively have fewer forced outages than overhead lines, damage to the cable or components often results in longer outage durations. When a failure does occur, overhead lines can be visually inspected quickly and repaired. In contrast, underground line cable failures cannot be visually diagnosed. The cable system must be tested with specialized equipment to locate the damaged sections of the cable. Upon locating the faulty component or cable, specially trained workmen must be mobilized to repair or replace the failed components or cable resulting in potential outages of weeks or months, depending on the type of failure to be repaired, the failure location, and the availability of replacement materials (damage to overhead lines can typically be repaired within several hours or days). The possibility of such extended outages remove undergrounding as a viable option for customers requiring high reliability (e.g. hospitals, manufacturing plants) or in areas where there is no redundancy to serve affected customers.

Basic maintenance of underground power line systems consists of thorough and frequent inspections. For transmission voltages, this could include a yearly inspection of the cable system and a monthly test and inspection of the fluid systems. Inspections would include all terminations and splices, all bonding systems, valves, gauges, switches, and alarms within the pumping plant. Cathodic protection systems would be monitored as an ongoing process.

Longevity: Long-term reliability of underground power line cables is a major concern for electric utilities. A catastrophic failure of any portion of an underground system (cable, splices, terminations, or fluid systems) could result in the cable system being inoperable and out of service.

Underground power lines have a substantially shorter life span than overhead power lines. The Edison Electric Institute (2012) estimates that much of the underground cable installed in the 1970s and 1980s now needs replacement. The effective longevity of an underground power line is about half that of an overhead power line.

A.1.b Environmental Considerations

Ground Disturbance: While access road requirements are similar for both underground and overhead lines, underground transmission lines require a continuous excavation through all habitat types. This is in contrast to overhead lines, which result in a habitat modification only at the structure locations. The ground modification is greater for underground lines than overhead lines of the same voltage. The need for trenching and additional ground disturbance of native vegetation may lead to the introduction of invasive plants and noxious weeds, soil compaction and other factors that impact the native vegetation/habitats along the ROW. However, these relatively greater ground modifications may be addressed similar to how other linear energy projects (i.e., pipelines) are addressed, via restoration, monitoring, and weed management programs. Prior to constructing a power line underground, utilities should consult with state and federal managers in areas where invasive/noxious weed expansion is a risk due to increased ground disturbance, both during construction and maintenance, associated with underground power lines.

In sagebrush habitat, continuous excavations would result in ground modification for the entire line route. This is in contrast to overhead lines, which result in a disturbance only at the structure locations and associated access routes. The extensive vegetation clearing required for underground power lines may cause fugitive dust or soil erosion problems, particularly in arid environments where re-establishing vegetation, particularly for sagebrush, may be difficult. Large shrubs and trees would be controlled within the ROW to prevent potential problems with roots that could interfere with the underground system. Underground lines would also require excavation for repairs or maintenance, which would result in ground disturbance occurring temporally over the life of the line, not just during initial construction. Ground disturbance during construction, repairs, and maintenance can result in large, permanent displacement of excavated soil and subsequent issues with re-establishing native vegetation. A University of California study (Bumby et al. 2009) found that underground power lines have more environmental impacts than overhead power lines for all categories and most scenarios in southern California; this study assessed environmental variables associated with the materials, construction, and operations of a power line. Likewise, environmental impacts of underground lines are greater than overhead lines due to ground disturbance, project footprint, vegetation removal, noise and dust associated with construction, construction duration, and subsequent ground disturbance and vegetation removal associated with maintenance and repairs (Tri-State Generation and Transmission Association 2011, Xcel Energy 2011, APLIC 2012). In addition to environmental concerns, underground lines can have a greater impact on archaeological and paleontological resources than overhead lines due to the amount of ground disturbance.

Additionally, environmental damage can result if a buried power line is near or crosses a waterway or is in sage-brush steppe or other sensitive habitats. If an oil-filled conductor pipe leaks, the oil could contaminate the water and surrounding soil, and damage sagebrush.

Human Activity During Construction and Maintenance/Repairs: Construction of underground power lines can take three to six times longer than overhead line construction (Tri-State Generation and Transmission Association 2011). Maintenance and repairs of underground power lines also take longer than overhead lines, as crews must excavate cables to identify problems and make repairs.

A.1.c Financial Considerations

One major reason that utilities do not normally install extra high voltage transmission lines underground is that the construction costs are increased by 4 to 17 times over the aboveground alternative (National Grid 2009, Patrick Engineering 2010, Public Service Commission of Wisconsin 2011, Tri-State Generation and Transmission Association 2011). More recent studies have shown that costs may be reduced but are still 10 to 12 times the cost of equivalent overhead installation (Patrick Engineering 2010). The Edison Electric Institute (2012) calculated cost ranges for transmission and distribution lines installed overhead or underground in different environments. In rural areas, they found that installation of overhead transmission lines cost between $174K and $6.5 million per mile, while underground transmission lines cost between $1.4 million and $27 million per mile. Similarly, costs per mile for distribution lines in rural areas ranged from $86.7K to $903K for overhead and $297.2K to $1.84 million for underground. In addition to construction costs, utilities must consider associated environmental costs, such as line planning/routing to avoid environmentally sensitive areas, biological surveys, environmental monitors, reclamation, mitigation, and other environmental-related costs. Depending on state and federal agency plans and project-specific mitigation requirements, mitigation costs may differ for overhead or underground lines. Some agency plans may consider line undergrounding as a form of mitigation, which could influence the overall project cost.

For investor owned utilities, the additional costs of undergrounding must be approved by the public utilities commissions and are passed on to all the ratepayers, not just those near the area of underground installation. For electrical co-ops, the additional costs of undergrounding would be passed on to members. In addition to the initial construction costs, long-term operations and maintenance costs are higher for power lines installed underground. Also, underground lines in geographic areas with severe frost, heavy snow, and/or rocky terrain can have further increased maintenance and repair costs.

Figure 8. Examples of underground power line construction.

A.2 Perch Discouragers

Nesting and perching of raptors and corvids on utility power lines and other tall infrastructure in sagebrush steppe habitats occupied by sage-grouse has been perceived as a threat to sage-grouse due to the potential for increased predation on both adults and young. Common raven (*Corvus corax*) nesting in southeastern Idaho was correlated with transmission lines and edges between sagebrush habitat and landscapes associated with human disturbance or fire (Howe et al. 2014). In northwestern Nevada, common ravens accounted for 46.7% of sage-grouse nest predation (Lockyer et al. 2013). While predation effects of ravens have recently been assessed, raptor predation of sage-grouse associated with tall structures is not well understood nor have there been many scientific studies conducted that have documented this threat in the scientific literature (Messmer et al. 2013).

Perch discouragers are a mitigation measure often recommended or required by federal land managers to prevent perching or nesting of corvids and raptors on distribution poles and transmission line structures in areas with sage-grouse or other sensitive species. Perch discouragers were originally designed to reduce raptor electrocutions, and were widely used by the electric utility industry from the 1970s to 1990s. Perch discouragers were intended to move birds from an unsafe (electrocution risk) perching location to a safer alternative, either on the same structure or nearby on the same line (APLIC 1996). For many years, perch discouragers were the only available option for retrofitting poles to reduce electrocutions. However, recent data has documented poor effectiveness in perch discouragers and greater effectiveness of covers for preventing electrocutions (APLIC 2006). This has resulted in a shift towards covers instead of perch discouragers for electrocution prevention.

Despite their declining use by electric utilities, perch discouragers have been installed in attempts to dissuade raptors and corvids from perching or nesting on power poles in areas with sage-grouse or other sensitive prey species. Perch discouragers are currently often required for new power line construction in sage-grouse priority habitats. There have been several studies assessing the effectiveness of discouragers in minimizing perching. This research has shown limited effectiveness in preventing perching (Lammers and Collopy 2007, Prather and Messmer 2010) with some species using alternate perch sites such as crossbraces and the shield wire to perch on when discouragers are present (Slater and Smith 2010). Below is a summary of perch discourager research.

- Lammers and Collopy (2007) conducted a study to evaluate the effectiveness of perch discouragers on the Falcon-Gondor transmission line in Nevada. This study found that although the duration of perching events was minimized on structures with discouragers, birds were still able to overcome the discouragers. Consequently, the authors felt that the discouragers did not achieve the desired results.
- Slater and Smith (2008) evaluated the effectiveness of existing perch discouragers on an H-frame transmission line in southwestern Wyoming. The line with perch discouragers

was adjacent to an existing line of similar construction without perch discouragers. The results of this study showed that birds used the structures without perch discouragers more than structures with discouragers, but perching was not entirely prevented. Given the close proximity of the two lines, the birds selected an "open" perch site as opposed to one with a barrier. The study documented the construction of a raven nest between deterrent devices. Two sage-grouse mortalities were documented during the study, which were suspected to have resulted from avian predation and a line collision.

- Prather and Messmer (2010) assessed the effectiveness of five different perch discourager installation types on a distribution line in southern Utah in an area with Gunnison sage-grouse. The study found that none of the discouragers were more effective than the control structures in preventing perching. The study also evaluated the line for sage-grouse predation but did not document any sage-grouse predation associated with the line. Rather, the majority of prey remains documented were lagomorphs. It should also be noted that the utility documented eagle electrocutions on this line associated with the discouragers after the study was completed (PacifiCorp, unpublished data).
- Rocky Mountain Power is conducting an ongoing study to monitor the effectiveness of perch discouragers and document avian use associated with a transmission line with spike discouragers in sage-grouse habitat in southwestern Wyoming (Liguori 2012). The study documented increased perching on H-frame transmission structures with discouragers compared to monopole designs, as well as perching on transmission line static conductors. A high rate of perch discourager mechanical failure was documented during the survey.
- PacifiCorp conducted avian risk assessment surveys of over 120,000 distribution poles from 2001 to 2012 in Utah, Wyoming, Idaho, Oregon, Washington, and California (Liguori 2013). During these surveys, raptor/raven perching was observed two times more frequently on poles with perch discouragers compared to poles without discouragers. Likewise, evidence of raptor use at poles (e.g., pellets, prey remains, whitewash) was 1.3 times greater at poles with perch discouragers compared to poles without discouragers. Perch discourager poles were also associated with increased electrocution mortality rates (3.6 times greater) and increased raptor/raven nesting on poles (4 times greater). Because of these unintended consequences, the company removed perch discouragers from its avian protection standards.

These various studies have documented that the availability of other perch sites influences the effectiveness of perch discouragers. In areas where there were other available perch sites nearby, perch discouragers appeared to be more effective and "pushed" birds from one perch location to another. In areas where other perch substrates were limited, the birds overcame the perch discouragers and were able to perch on the structures despite the discouragers.

Because perch discouragers may push birds to nearby poles that may pose an electrocution risk, their use has been discouraged (APLIC 2006). Likewise, in areas where raven predation on sage-grouse nests is a concern, perch discouragers may aid in the accumulation of nest material (APLIC 2006), and could potentially increase raven predation pressure due to nest construction on discouragers in sensitive areas. An investigation of landscape-level patterns in common raven behavior and distribution in Wyoming suggested that the majority of sage-grouse nest predation by common ravens is carried out by resident territorial individuals (i.e., nesting birds), rather than non-breeding individuals (Bui et al. 2010). The negative impacts of perch discouragers must be weighed against the limited benefits they may provide, particularly if they are contributing to mortalities of birds protected under ESA, MBTA, BGEPA, and State laws, and facilitating increases in predator nesting populations.

The avian predators of sage-grouse should also be considered, as different species exhibit different hunting strategies, and employ different hunting techniques for different prey species. For example, golden eagle (*Aquila chrysaetos*) diet is largely mammalian (80-90%, Kochert et al. 2002). Golden eagles prey on sage-grouse opportunistically, and typically hunt sage-grouse by stooping from a high soar (Watson 1997, Kochert et al. 2002). Consequently, power poles may not play an important role in eagle predation of sage-grouse. Golden eagles, however, are vulnerable to electrocution mortality (APLIC 2006) and perch discouragers have been correlated with increased eagle electrocution risk (PacifiCorp, *in prep*.). Common ravens are known predators of sage-grouse nests, yet ravens are able to overcome perch discouragers and may experience higher nesting rates on poles with perch discouragers.

These sage-grouse BMPs are intended to be compatible with conservation measures for other protected species (e.g. electrocution prevention measures for raptors and other migratory birds). Consequently, prior to the use of perch discouragers, utilities and resource agencies should assess their potential risks/benefits to sage-grouse as well as other protected avian species.

Figure 9. Examples of perch discouragers, including perching and nesting.

Red-tailed hawk (and mountain bluebird) perched on H-frame pole with perch discouragers

Red-tailed hawk (left) flushing common raven (right) from transmission pole with perch discouragers.

Common raven nest on transmission pole with spike discouragers.

Common raven nest on transmission pole with steel “Y” discouragers.

Golden eagles perched on adjacent distribution poles with moving/hazing and barrier-type discouragers

Golden eagle perched on distribution pole with cone discouragers, and common raven perched on conductor

Appendix B. WAFWA White Paper on Sage-grouse/Power Line Research

Insert document (attached) into final pdf

Appendix C. Examples of Different Power Line Configurations

Insert document (attached) into final pdf

Appendix D. Examples of Construction Equipment and Activities

Insert document (attached) into final pdf