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## INTRODUCTION

Solar energy is one of the newest energy sectors in Alberta and is one of the fastest growing energy industries in the world. The Government of Alberta's Climate Leadership Plan recognizes that the development of renewable energy will help reduce greenhouse gas emissions, diversify energy supplies, stimulate regional activity, and fortify collaboration across industry sectors. The *Alberta Renewable Energy Act* (2017) identifies a target that 30% of Alberta's energy needs will be produced from renewable energy sources, such as solar, by 2030.

While considered a source of renewable clean energy, solar energy has both direct and indirect effects on wildlife (Hernandez et al. 2014, Walston Jr. et al. 2015). The majority of research has been focused on avian populations, however, there are many unknowns surrounding the direct impacts to all species including native plants, birds, amphibians, reptiles and mammals. Solar energy projects that are appropriately sited and design avoid or minimize these effects. Standardized pre- and post-construction surveys of wildlife species and habitat characteristics are key components to inform appropriate site selection and mitigation of impacts to wildlife and wildlife habitat from the construction and operation of solar energy projects. The role of the Government of Alberta's Ministry of Environment and Parks (AEP) is to ensure that development of solar energy projects include appropriate consideration and mitigation of potential negative effects on Alberta's wildlife and wildlife habitat.

This document summarizes potential wildlife issues associated with solar energy projects and provides a Directive for minimizing effects to wildlife and wildlife habitat during the siting, construction, and operational phases of solar energy projects. It is to be applied to all solar energy project applications and renewals going forward from the date that this Directive is finalized and released by the AEP. It is intended to inform solar energy project developers and the Alberta Utilities Commission (AUC) of potential wildlife issues and AEP expectations to avoid and minimize negative impacts to wildlife. It will help solar energy project developers to provide consistent wildlife-related information in solar energy project applications submitted to the AUC. It is recognized that each project is unique and may require an adaptive approach; therefore this document does not preclude alternative mitigation identified by the AEP Wildlife Biologist and solar energy project developers. Additionally, this Directive serves to assist the AEP Wildlife Biologist in advising solar energy project developers, responding to



stakeholder inquiries related to regulatory applications, and providing consistent information in Wildlife Renewable Energy Referral Reports submitted to the AUC.

As our understanding of the effects of solar energy projects on Alberta's wildlife improves, so will our ability to manage these effects. The Directive will be reviewed at least every ten years. However the Directive does not have an expiry date, and may be amended in the interim as new research and information becomes available. To access the most current version of this document, search for "Wildlife Directive for Solar Energy Projects" on <http://www.alberta.ca>.

## SCOPE AND APPLICATION

Issues surrounding solar energy projects are multi-faceted and extend beyond wildlife concerns. The scope of this Directive, however, is limited to those issues affecting wildlife and wildlife habitat throughout Alberta.

Recommendations from AEP Wildlife Biologists are based on the legislative authority of the *Wildlife Act* and *Environment Protection and Enhancement Act (EPEA)* and are designed to protect wildlife (including species at risk) and wildlife habitat from the potential impacts of the development of a solar energy project and operation. AUC Rule 007 (<http://www.auc.ab.ca/acts-regulations-and-auc-rules/rules/Pages/Rule007.aspx>) applies to applications for the construction, alteration, operation, discontinuation, dismantling and removal for power plants, substations, transmission lines, industrial system designations and hydro developments. AUC Rule 007 requires that proponents ensure that environmental (including wildlife) information, effects and mitigation are addressed in the application. For solar energy projects, AUC Rule 007 also requires that proponents submit with their applications a copy of a signed Wildlife Renewable Energy Referral Report received from an AEP Wildlife Biologist.

Review by a AEP Wildlife Biologist is not required when solar energy projects are small-scale (i.e. less than 1MW) or within urban areas as solar energy infrastructure has inherently low impacts on wildlife when integrated into an existing anthropogenic footprint such as on rooftops (Pimental et al. 1994, Tsoutsos et al. 2005, Dale et al. 2011).

This Directive is to assist industry in planning, constructing and operating solar energy projects in a manner that minimizes effects on wildlife and wildlife habitat. Many species are protected under the provincial *Wildlife Act* and by the federal *Migratory Birds Convention Act* or the *Species at Risk Act (SARA)*. Proponents applying to develop solar energy projects are responsible for complying with all federal, provincial, and municipal requirements relevant to their proposed solar energy projects. The wildlife and wildlife habitat outcomes expected from implementing this Directive are described in Appendix A.

Wildlife and plant species requiring special management are described as "Species at Risk", referring primarily to species that have been provincially (Alberta - *Wildlife Act*) or federally (Canada - *Species at Risk Act (SARA)*) listed as Endangered, Threatened, or Special Concern. The term may also be used to describe species identified as "May Be at Risk" or "Sensitive" through the *Alberta Wild Species General Status Listing* (search for 'General Status' on <http://www.alberta.ca>).

This Directive addresses all wildlife within Alberta regardless of whether they fall under federal or provincial jurisdiction, or are on privately-owned or Crown land. However, for species under federal jurisdiction (i.e., aquatic species and migratory birds) that occur on provincial lands, or for all wildlife on federal lands, there are additional federal government requirements. These can be identified by contacting Natural Resources Canada, which is the federal agency responsible for solar energy project development on federal lands such as National Parks and Military Reserves. It is the responsibility of the applicant to determine the nature of any additional federal requirements, and to ensure that these requirements are met.

Proponents should consider the potential wildlife impacts by infrastructure outside the footprint of solar collectors or reflectors, such as accompanying power lines, collection lines, substations, fences, and roads. This Directive applies to all solar energy infrastructure within the area defined by the solar energy project boundary and referred to in this Directive as the “solar energy project”. However, if an expansion of the scope of this Directive is necessary at a future time, it will be amended to reflect that decision.

## WILDLIFE ISSUES RELATED TO SOLAR ENERGY PROJECTS

This section describes the two major types of utility scale solar energy technology used in North America and the anticipated impacts to wildlife from the structures and facility requirements of each technology.

### Types of Solar Technology

1. **Photovoltaic (PV):** solar panels, a type of solar collector, directly convert sunlight into electricity to export to the grid (Huso et al. 2016). Solar cells are made of layers of semiconductor materials which create electricity directly from the sun’s rays. Typical PV systems are made up of multiple solar cells, known as solar arrays; for utility scale solar projects there may be hundreds of arrays interconnected into a single system (Singh 2013).
2. **Concentrated Solar Power (CSP):** mirrors, a type of solar reflector, are used to focus sunlight on a receiver that collects thermal energy to produce electricity, typically by driving a steam generator (Huso et al. 2016). CSP technology can be further broken into three categories:
  - **Power tower system:** uses a field of movable mirrors, called heliostats, to concentrate the sun’s rays on a large receiver tower to heat fluid for electricity generation using steam turbines (Whitaker et al. 2013). Typically, water is used as the heat transfer fluid and some systems have the energy storage capabilities for continued electricity generation at night (NREL 2016).
  - **Linear concentrator system:** uses long mirrors to focus solar radiation on a central tube where a fluid absorbs the thermal energy, the fluid-based system then heats water to create steam to run conventional steam turbines (Burkhardt et al. 2011). The parabolic trough and the linear Fresnel reflector systems are the most common types of linear CSP systems (NREL 2016).
  - **Dish-engine system:** uses mirrors oriented in a dish shape, similar to a satellite dish, to concentrate solar rays on a central thermal receiver that transfers the heat to the engine generator. The engine requires heat to move pistons that create mechanical energy and can then generate electricity (NREL 2016).

CSP technologies require cooling systems. Although dry-cooled systems have been developed, the wet-cooled systems are more efficient, but necessitate coolant chemicals.

### Wildlife Issues

The following section outlines wildlife concerns of utility scale solar energy projects in Alberta. These concerns are based on the best information available, however, this list is not considered an all-inclusive list.

1. **Mortality risk:** Wildlife mortality has been documented at a number of solar energy projects in North America; the cause and risk of mortality differs based on the type of solar energy technology (Kagan et al. 2014, Walston Jr. et al. 2016).

At PV facilities, the primary mortality risk to avian wildlife is through direct collision with solar collectors or stranding following impact (Kagan et al. 2014, Huso et al. 2016, Walston Jr. et al. 2016). Waterbirds have

increased susceptibility to collisions, potentially explained by the “lake effect” hypothesis, where solar collectors attract birds due to similarity between polarized light reflected off of panels when compared with light reflecting off water (Horváth et al. 2009, 2010, Kagan et al. 2014). It is currently unknown if the “lake effect” hypothesis is applicable in Alberta because most of the research on the topic has been conducted in Europe and the United States so further studies are necessary in Alberta. In other locations it has been documented that when waterbirds attempt to land on panels some birds are killed on impact; however, survivors may become stranded and later die from injuries, predators, dehydration, or starvation (Kagan et al. 2014, Huso et al. 2016). Grebes, loons, and other diving waterbirds are particularly vulnerable to stranding because they require water to take flight. Similarly, passerines have increased mortality risk due to collision, likely due to presence of foraging opportunity that may be enhanced by the attraction of insects to the solar collectors and potential nesting location availability within solar energy project (Horváth et al. 2010, Hernandez et al. 2014, Kagan et al. 2014).

The primary mortality risk associated with power tower CSP technology is caused by solar flux injury resulting in incineration or singeing of feathers causing reduced maneuverability after flying through concentrated solar reflections (McCrary et al. 1986, Ho et al. 2010, Kagan et al. 2014, Walston Jr. et al. 2015). Other reported causes of mortality or injuries at CSP sites include but are not limited to; temporary or permanent blindness, collisions with infrastructure, collisions with solar reflectors, contact with or ingestion of hazardous chemicals (Ho et al. 2010, Lovich and Ennen 2011), or mortality in open cooling ponds. Causes of mortality from open cooling ponds may be related to exposure to chemicals used in the cooling ponds, drowning or other related causes.

Other sources of direct wildlife mortality associated with solar energy infrastructure for both PV and CSP technology includes but is not limited to: collisions with collector lines, electrocution on power lines, anthropogenic wildlife traps, vehicle collisions, and collisions with guy wires and fences (APLIC and USFWS 2005, Longcore et al. 2008, Dickey et al. 2012, Kagan et al. 2014, Huso et al. 2016). Furthermore, Endangered or Threatened plants, designated under the *Wildlife Act*, and vulnerable plant communities may be lost due to physical removal during the construction phase.

- 2. Habitat loss and fragmentation:** Construction and operation of solar energy projects can result in habitat loss and fragmentation (BLM and DOE 2012). In general, habitat loss is the largest contributor to negative impacts on biodiversity and is of particular concern in areas of high historic habitat loss (Fahrig 2003), such as Alberta’s native prairie and parkland habitats. Solar energy project development on native grassland habitat would present a much larger impact to wildlife than on agricultural land, brownfields, or other areas with significant anthropogenic disturbance (AEP 2016a). In general, the effects of habitat fragmentation on wildlife are not as significant when compared to the effects of habitat loss. However, habitat fragmentation may lead to species-specific area sensitivities, obstacles to migration, barriers to gene flow and negative edge effects that can lead to a decrease or loss of local populations (Fahrig 2003, Lovich and Ennen 2011).

Risks associated with habitat loss and fragmentation are significant for sensitive species and species at risk because they typically require large amounts of contiguous habitat and are generally more susceptible to edge effects and habitat alteration (Fahrig 2003, AEP 2016a). Further, some unique vegetation communities (e.g. rough fescue grasslands) or wildlife communities (e.g. greater sage grouse and silver sagebrush community) cannot be adequately reclaimed post-disturbance, resulting in permanent habitat loss (Aldridge and Boyce 2007, GOA 2010, AEP 2016a).



- 3. Degradation of habitat quality:** Infrastructure and activities within the solar energy project may result in decreased habitat quality and lead to avoidance of the area by wildlife or attraction of species associated with anthropogenic features, such as magpies or ravens (Knight and Kawashima 1993, Kristan and Boarman 2003, Lovich and Ennen 2011). Species of increased conservation concern, such as species at risk, are often at higher risk for avoidance; however impacts of habitat avoidance and degradation are species-specific. General area avoidance or unnatural attraction and habitat degradation from energy development can be caused by increased noise levels, increased human presence, introduction of non-native or invasive vegetation, alteration of hydrology, increase of predator populations and introduction of above-ground structures, which can act as perches for avian predators, among other factors (Helzer 1999, Barber et al. 2010, Lovich and Ennen 2011, BLM and DOE 2012, Grippo et al. 2014).

Although limited research has been conducted on the effects of solar energy projects on non-bird species such as ungulates, amphibians, reptiles and invertebrates, a great deal of research exists on the largely negative effects of other industrial disturbances with similar components (e.g., construction, vehicles, human use) on these species.

## THE APPROACH

This Directive provides information on the requirements and recommendations for solar energy projects in Alberta to avoid or mitigate the risk to wildlife and wildlife habitat. Organization of this document follows a tiered approach, whereby sequential stages allow the proponent to proceed logically along a pathway to evaluate, avoid, and minimize negative effects of solar energy projects on wildlife and habitat. Appropriate site selection of a project will reduce the risks posed to wildlife. Any remaining risks to wildlife or wildlife habitat will be addressed in the construction and operation mitigation plan that will describe site- or species-specific mitigations.

Each stage outlines requirements (Standards) or recommendations (Best Management Practices) to avoid or minimize the risks a proposed solar energy project may have on wildlife and wildlife habitat:

1. Standards - provide siting, timing and site-related wildlife conservation requirements that are to be met in the planning and development of a solar energy project. All Standards are preceded by “100”.
2. Best Management Practices (BMPs) - practices that may assist in the planning and location of activities. BMPs are designed to inform the proponent of desired practices while planning and operating in Alberta. BMPs are provided for information and consideration in the planning of solar energy projects to support better conservation and protection of wildlife and wildlife habitat. All BMPs are preceded by “200”.

Under Rule 007 regarding the AUC application process, there is a requirement to demonstrate that environmental concerns (including relating to wildlife) are addressed. In the case of an emergency situation, Standards listed in this Directive may be exempt during the emergency period.

It is the responsibility of the proponent to ensure that the Standards are implemented and that BMPs are given consideration and implemented where practical for the solar energy project.

## STAGE 1: SITE SELECTION

“Site selection” refers to the selection of a location for a solar energy project within a landscape-level or regional study area. Appropriate site selection at the landscape level is the first and most critical factor in preventing significant negative effects on wildlife. Impacts to wildlife from solar energy projects are highly site-specific. A well-sited solar energy project is one that minimizes impact on wildlife and wildlife habitat and limits the need for mitigation measures (Tsoutsos et al. 2005, Northrup and Wittemyer 2013). Strategic site selection should enable solar energy projects to be incorporated into current land-use regimes without impacting land of high conservation or wildlife habitat value (Fluri 2009, McDonald et al. 2009, Cameron et al. 2012). AEP expects solar energy project proponents to select sites with minimal wildlife and wildlife habitat concerns. If preliminary information for a potential site indicates a high risk to wildlife (i.e. presence of native grasslands, wetlands, or records of sensitive species, etc.), alternate locations should be sought. Once a site is proposed, pre-construction wildlife surveys, timing of construction and infrastructure design will be used to address site- or species-specific risks within the solar energy project (Stages 2-4).

### 100.1 Standards

- 100.1.1 Solar energy projects and temporary work spaces must be sited to avoid or minimize their occurrence in important wildlife habitats (ASRD 2011). Generally, solar energy project should not be sited in areas of native grasslands, native parkland, old growth forest stands, named water bodies, valley breaks (including coulees), valleys of large permanent watercourses and the eastern slopes region.
- 100.1.2 Without limiting Standard 100.1.1, solar energy projects are not allowed in the following Wildlife Zones:
- Greater Sage-Grouse Range (inclusive of the area described in the Emergency Order for the Protection of the Greater Sage-Grouse) (GOC 2014)
  - Trumpeter Swan Waterbodies and Watercourses (inclusive of 800m setback<sup>1</sup> from waterbody and watercourse)
  - Caribou Zones
  - Mountain Goat and Sheep Zones
  - Piping Plover Waterbodies (inclusive of 200m setback from waterbody)
- 100.1.3 Solar energy projects must be appropriately sited to avoid or minimize their occurrence in the following mapped Wildlife Zones:
- Special Access Zones
  - Key Wildlife and Biodiversity Zones
  - Grizzly Bear Zones
- 100.1.4 Solar energy projects must be appropriately sited to avoid Critical Habitat<sup>2</sup> (i.e., fish, wildlife and plant species).

<sup>1</sup> Note that within this document, a setback is measured from the edge of the feature to the nearest edge of the project footprint.

<sup>2</sup> Critical Habitat is defined by the Government of Canada, for more information on locations refer to the specific species federal recovery strategy.

- 100.1.5 To determine the possible occurrence of species at risk or sensitive plants and animals in the proposed area of the solar energy project, applicants must examine the available data from AEP for the proposed solar energy project plus a 1km buffer zone around all disturbances associated with the project. Data sources include the Fish and Wildlife Management Information System (FWMIS), Wildlife Sensitivity Data Sets (i.e., key range layers and key wildlife layers), Landscape Analysis Tool (LAT), Alberta Conservation Information Management System (ACIMS; for occurrences of rare plant species), and available habitat identification tools where available (e.g., Habitat Suitability Index (HSI) tools, Resource Selection Function (RSF) modeling tools). Applicants must contact the appropriate AEP Wildlife Biologist to request a search of the FWMIS database; initial database searches can be conducted by searching “FWMIS” on <http://www.alberta.ca>.
- 100.1.6 The solar energy project will not create new open access development in Grizzly Bear Watershed Units approaching or exceeding open road thresholds as per the Alberta Grizzly Bear Recovery Plan as amended (AEP In press).
- 100.1.7 The solar energy project must not occur within 100m from the top of a valley break (including coulees).
- 100.1.8 The solar energy project must not occur within 1000m of a named lake, as per NRCAN (2016).
- 100.1.9 The solar energy project must not occur within 100m of any wetland class (bog, fen, marsh, shallow open water, swamp) identified in Table 1 in the Alberta Wetland Classification System except for wetland classes with Water Permanence listed as Temporary within the aforementioned Table (ESRD 2015).
- 100.1.10 The solar energy project must not occur within:
- 45 meters from the top of the break of intermittent watercourses or springs
  - 45 meters from the top of the break of small permanent watercourses
  - 100 meters from the top of the break of large permanent watercourses
- 100.1.11 Solar energy projects using power tower CSP technology will be identified by the AEP Wildlife Biologist in the signed Wildlife Renewable Energy Referral Report as a high unmitigated risk for wildlife due to the high levels of wildlife mortality associated with this technology.

## 200.1 Best Management Practices

- 200.1.1 The solar energy project should not occur within 1000m of a wetland based Important Bird Area (IBA) as per IBA Canada (<http://www.ibacanada.ca>).

## STAGE 2: PROJECT LAYOUT AND PRE-CONSTRUCTION SURVEYS

At this stage, an appropriate general location has been selected and consideration regarding project layout, planning and surveys begin. Minor shifts in project footprint and layout may need to occur depending on the setback distances of local wildlife features and habitat. Project proponents must conduct pre-construction wildlife and vegetation surveys that adequately cover the entire solar energy project area. Surveys are to be designed, conducted and supervised by experienced wildlife biologists and appropriate environmental professionals. Surveys will be designed based on local and migratory wildlife species assemblages, habitats, area topography and project design. Pre-construction planning and surveys provide a baseline and identify potential risks to wildlife. Subsequently, the proponent and AEP Wildlife Biologist should discuss appropriate mitigation for the solar energy project prior to issuance of a signed Wildlife Renewable Energy Referral Report and prior to construction.

### 100.2 Standards

100.2.1 Solar energy project proponents must conduct pre-construction wildlife surveys for the solar energy project area. Survey methods must follow the *AEP Sensitive Species Inventory Guidelines*, as amended. If AEP survey protocols are not defined, surveys must be done with the best available scientifically accepted practices. The AEP Wildlife Biologist must be consulted to discuss additional surveys that may be required, but do not have guidelines published in the *Sensitive Species Inventory Guidelines* (i.e., grizzly bear den surveys). To obtain the current AEP survey protocols search “wildlife survey methods” on <http://www.alberta.ca>.

The following surveys are required, at a minimum, for all solar energy project submissions:

- Spring and fall migration surveys for migrating avian species. A minimum of three migration surveys will be completed in both the spring and fall season as follows; one early season, one mid-season and one late season (refer to Appendix B).
- Raptor nest searches within the 1000 m buffer area<sup>3</sup>.
- Breeding bird surveys (two surveys): early species (May 1st to June 15th) and late species (June 16th to July 15th).
- Field investigations to determine habitat types, including the presence and extent of native grasslands and other sensitive habitats (e.g., wetlands, riparian habitats, rare ecological communities) (ANPC 2012, GOA 2013a).

Surveys for the associated wildlife are required if the solar energy project area occurs within the following Key Range or Wildlife Layer (see Standard 100.1.4; also search for ‘Wildlife Sensitivity Maps’ on <http://www.alberta.ca>):

- Burrowing Owl Range
- Eastern Short-horned Lizard Range
- Endangered and Threatened Plant Ranges
- Ord’s Kangaroo Rat Range
- Sensitive Snake Species Range
- Sharp-tailed Grouse Range
- Swift Fox Range

<sup>3</sup> Raptor searches are required throughout the province of Alberta; however, the type of raptor survey differs between Grassland/Parkland regions and Boreal/Montane/Alpine/Canadian Shield regions. Refer to the *Sensitive Species Inventory Guidelines* for more information.



- Colonial Nesting Bird Range (within 1000m of point data)
- Grizzly Bear Core and Secondary Zones

- 100.2.2 All pre –construction wildlife surveys required by this Directive must be conducted for a minimum of one year (see Standard 100.2.1). All wildlife surveys must be considered current at time of submission to AEP (for definition of current survey see Glossary).
- 100.2.3 The required setbacks and timing restrictions must be adhered to for all wildlife and habitat features detected by surveys. Solar energy projects must follow all setbacks described in Appendix C.
- 100.2.4 The proponent must ensure that the following surveys are kept current (for definition of current survey see Glossary) between the issuing of a signed Wildlife Renewable Energy Referral Report and commissioning of the project:
- Burrowing Owl
  - Raptor nest searches
  - Sharp-tailed Grouse
  - Swift Fox
  - Ord’s Kangaroo Rat
  - Grizzly Bear Den
  - Endangered and Threatened Plants
- 100.2.5 Projects for which construction has not commenced within 5 years of completion of pre – construction wildlife surveys outlined in Standard 100.2.1 will need to repeat all wildlife surveys to ensure accuracy of AEP’s wildlife risk assessment. Discussions with the AEP Wildlife Biologist will need to be re-initiated to account for the delay in project development and updating of pre - construction wildlife surveys.
- 100.2.6 A comprehensive wildlife report must be submitted that details: methods, results, interpretation of results, and mitigations as per Stage 2 of the Directive. Following the completion of surveys, data collected must be submitted to the AEP Wildlife Biologist in the appropriate format for entry into Fish and Wildlife Management Information System (FWMIS) (and to Alberta Conservation Information Management System (ACIMS) for rare vegetation).
- 100.2.7 Fencing, including type, shape, layout, and continuous length must be planned to avoid impeding normal wildlife movement in the area and to reduce the chance of collision and/or entrapment. Wildlife that must be considered in fence design include but are not limited to:
- Large mammals, such as ungulates, specifically pronghorn
  - Ground nesting birds and their young (waterfowl, grouse, etc.)
  - Reptiles
  - Amphibians

## **200.2 Best Management Practices**

- 200.2.1 The proponent should avoid siting solar energy projects within habitat of plants that are species of special concern.
- 200.2.2 The proponent should avoid temporary waterbodies and watercourses as defined by the *Alberta Wetlands Classification System* (ESRD 2015).

- 200.3.1 Any mature, wide poplars (dead or living) of 34cm diameter at breast height or greater should be maintained, regardless of whether a nest has been located in the tree (AEP 2016b).
- 200.3.2 Activities should be located adjacent to existing operations, existing access, or within anthropogenic clearings wherever practical to minimize the spatial extent of cumulative disturbance as well as to minimize the need for associated access. Integrated Land Management (ILM) principles should be considered in all submission. To access this information, search 'Integrated Land Management' on <http://www.alberta.ca>.
- 200.3.3 New disturbances should avoid complex, multi-story, mature mixed-wood forest whenever possible. Young, single-species stands of trees should be selected as the alternative site for the disturbance if one exists nearby.

## STAGE 3: CONSTRUCTION AND OPERATION MITIGATION

It is important to reduce effects of solar energy infrastructure construction and operation on wildlife. Solar energy project proponents must develop site- and species-specific construction and operational mitigation plans that meet the expectations outlined in this Directive. Solar energy project developers are expected to incorporate mitigation plans into the design of all solar energy projects. Areas of temporary disturbance, including those occurring outside of the final footprint must be included in construction stage mitigation plans. Construction and ongoing mitigation techniques are described below.

### 100.3 Standards

- 100.3.1 The proponent must develop and submit to AEP a construction and operation plan that complies with this Directive. Operations include all operational activities, including maintenance.
- 100.3.2 The plan construction and operation plan must include details of, but is not limited to: timing restrictions, management of noise, wetland protection, protection and management of wildlife movement, process for preventing and responding to stranded and injured wildlife, predator (e.g. corvids) nest prevention on anthropogenic features, power line electrocution/collision risk mitigation, minimization of vehicle-wildlife collision risk, minimization of light pollution and other site- or species-specific issues.
- 100.3.3 The proponent must sequence construction activities to avoid sensitive periods for wildlife, such as the breeding season. Without limiting the generality of the foregoing, construction activities in native grassland habitats must occur outside of April 1st to July 15th (grassland bird breeding season), including the need to comply with species-specific timing restrictions (ASRD 2011). Additionally, AEP Wildlife Biologists recommend that proponents consult with the Canadian Wildlife Service to ensure compliance with the *Migratory Birds Convention Act*.
- 100.3.4 Proponents must develop and submit to AEP a mitigation plan to address any new wildlife locations identified, based on continued surveys as per Standard 100.2.4.
- 100.3.5 The mitigation plan must include, but is not limited to: timing conditions, protective barriers, site monitors, or other mitigation techniques developed in consultation with AEP.
- 100.3.6 If operating within Key Wildlife and Biodiversity Zone, solar energy project construction and maintenance activities must not occur during the identified periods:
  - a) For all areas north of Highway #1, no activity is permitted from January 15th to April 30th.
  - b) South of Highway #1, west of Highway #2, no activity is permitted from December 15th to April 30th.
- 100.3.7 All construction activities associated with a solar energy project must minimize habitat disturbance and fragmentation through use of available minimum disturbance techniques such as matting, reduced soil stripping, frozen construction, minimized fencing and reduced road grades (see Appendix D).
- 100.3.8 Where vehicular access is required to be developed to, or within, Grizzly Bear Zones, Key Wildlife and Biodiversity Zones or Special Access Zones, the use of temporary access (Class IV, V, and VI) is required. Temporary roads must be closed to prevent unauthorized access and reclaimed immediately after construction (see Appendix D).

- 100.3.9 If upgraded vehicle access is required to be developed within a solar energy project that is located within Key Wildlife and Biodiversity Zone or Special Access Zone, it must have sufficient road-side vegetation to eliminate line-of-sight into clearings. Road-side vegetation is not required if line-of-sight from the road is limited to a maximum of 200m using opening size, topography, residual structure, etc..
- 100.3.10 All newly constructed roads developed to or within a solar energy project must be designed as dead-ends and should not loop through the area when located within Grizzly Bear Zones.
- 100.3.11 All newly constructed roads developed to or within a solar energy project in Grizzly Bear Zones must run perpendicular to creeks or rivers.
- 100.3.12 When a solar energy project is located in forested areas, including Grizzly Bear, Key Wildlife and Biodiversity and Special Access Zones, line-of-sight must be limited to 200m on non-roadway linear features (cross-country). New linear disturbances that intersect existing roadways must incorporate techniques that reduce the line-of-sight from the existing roadway; techniques include using live vegetation, doglegs, and boring.
- 100.3.13 Access control and access management must be implemented for solar energy projects within Grizzly Bear, Key Wildlife and Biodiversity and Special Access Zones (see Appendix E).
- 100.3.14 For new access roads within the Grizzly Bear Zones associated with a solar energy project, treed buffers (at least 10m wide) must be maintained along roads that parallel cleared areas or as informed by Foothill Research Institute's sightability tool (see <http://www.friresearch.ca>).
- 100.3.15 Permanent solar energy infrastructure within Grizzly Bear Zones must be constructed within 100m of existing arterial all-weather permanent access.
- 100.3.16 Any watercourse crossings must comply with the *Water Act of Alberta*.
- 100.3.17 If guy wires are required for any solar energy infrastructure, they must be equipped with markers specifically designed to prevent bird collisions.
- 100.3.18 Solar energy project collection lines must be placed underground using minimal disturbance construction techniques (Bradley and Neville 2011).
- 100.3.19 Where construction activities pose a high risk to wildlife, an experienced wildlife biologist (see glossary) must be on site to monitor wildlife behaviour during construction and to propose and implement on-site mitigation actions. Under such circumstances proposed monitoring plans will be consistent and meet with the intent of this Directive.
- 100.3.20 Legumes shall not be seeded for re-vegetation of any linear disturbance associated with solar energy projects located within Grizzly Bear Zones.
- 100.3.21 All solar energy projects located in bear habitat must manage attractants.

## 200.4 Best Management Practices

- 200.4.1 Proponents should minimize the need for operational personnel on site during sensitive wildlife time periods.



- 200.4.2 Proponents should minimize the footprint of the solar energy project.
- 200.4.3 Impacts to wildlife and wildlife habitat from lights should be minimized. Lighting for on-ground infrastructure should be reduced, down-shielded and controlled by proximity sensors wherever possible.
- 200.4.4 Proponents should design the solar energy project to minimize new linear access. Coordinated access and industrial development strategies, which integrate the sequencing (time and space) of construction activities, should be used to minimize human footprint. The amount of cumulative vegetation clearing should be minimized through an integrated review of planned disturbance between all land users. Proponents should contact other companies operating in the area to coordinate and integrate planned linear disturbance.
- 200.4.5 Progressive or interim reclamation to equivalent land capability should be carried out once construction of the permanent solar energy infrastructure is complete.
- 200.4.6 Once no longer used for the solar energy project, the inactive portion(s) of the access road that is within 100m of a public road(s) should be closed to motorized vehicle traffic within one year of non-use.
- 200.4.7 All workers operating in bear areas should be provided with 'Bear Awareness Training'.
- 200.4.8 All activities should follow the industrial practices in the Alberta Bear-Human Conflict Management Plan for Camps (see Appendix F).
- 200.4.9 Crossings of permanent watercourses should be avoided whenever possible.
- 200.4.10 Proponents should manage construction activities to prevent and control the spread of invasive species.
- 200.4.11 If construction activities on native grassland habitats are unavoidable and have suitable justification accepted by the AEP Wildlife Biologist, the following guidelines are to be used – *Principals for Minimizing Surface Disturbance in Native Grasslands* (search for “native grassland disturbance” on <http://www.alberta.ca>) (AEP 2016a).
- 200.4.12 Proponents should avoid using guy wires on permanent communication or meteorological towers (Longcore et al. 2008, Dickey et al. 2012).
- 200.4.13 Where underground power lines cannot be constructed due to landscape constraints, above-ground power lines should parallel existing power lines where practical and be designed to avoid collision and electrocution of birds. AEP Wildlife Biologist expects solar energy project proponents to comply with the suggested practices developed by the Avian Power Line Interaction Committee (APLIC 2006, 2012).



## **STAGE 4: POST-CONSTRUCTION WILDLIFE MONITORING AND ADAPTIVE MANAGEMENT**

Post-construction wildlife monitoring is intended to assess the effectiveness of mitigation efforts and identify any ongoing wildlife risks through carcass surveys and wildlife monitoring. Monitoring determines whether additional or modified operational mitigation is required. Monitoring will be designed, conducted and supervised by experienced wildlife biologists and appropriate environmental professionals. Adaptive management is an iterative learning process producing better understanding and improved management over time and will be taken into account for all solar energy projects.

Site characteristics and results of pre-construction surveys will determine the duration and level of effort of post-construction monitoring. Regardless, the AEP Wildlife Biologist requires a post-construction monitoring plan to evaluate and identify the solar energy project's effects on wildlife.

### **100.4 Standards**

- 100.4.1 The proponent must develop a post-construction wildlife monitoring plan and mitigation plan that complies with this Directive.
- 100.4.2 The proponent must conduct post-construction monitoring wildlife surveys annually, for a minimum of three years, after the solar energy project is operational.
- 100.4.3 Post-construction monitoring survey required by Standard 100.4.1 must:
  - a) document wildlife mortalities<sup>4</sup> within specific solar arrays,
  - b) determine carcass removal rate by scavengers or other means,
  - c) determine searcher efficiency in detecting wildlife carcasses, and
  - d) monitor impacts of the solar energy project on species at risk, sensitive species or other wildlife (Huso et al. 2016).
- 100.4.4 The post-construction monitoring survey and mitigation plan developed for each solar energy project must define: seasonality, frequency, extent and duration. For analysis purposes, injured or stranded wildlife will be treated the same as dead wildlife; however, the response to injured or stranded wildlife will differ from dead wildlife. The following minimum standards for post-construction monitoring plans must be met:
  - a) Seasonality: Surveys will target periods of greater risk of mortality (i.e., spring and fall migration and summer breeding; see Appendix B). Surveys must be conducted:
    - i. Between March 1st and November 15th within the Grassland and Parkland Natural Region,
    - ii. Between April 1st and September 30th within the Boreal and Rocky Mountain Natural Regions.
  - b) Frequency: Surveys will be conducted weekly during the migratory periods and once every two weeks during the summer. Migratory periods occur:
    - i. from March 1st to May 15th and from August 15th to November 15th within the Grassland and Parkland Natural Region,
    - ii. from April 1st to May 30th and from August 1st to September 30th within the Boreal and Rocky Mountain Natural Regions.

<sup>4</sup> For the purpose of this Directive all carcasses found within the solar energy project footprint will be assumed to be associated with the solar energy project, unless otherwise agreed to by the reviewing AEP Wildlife Biologist.

- c) Extent: for projects equal to or less than 10MW the entire area of the project must be monitored or for projects greater than 10MW, one third of the solar energy project area must be monitored. Sample area will be randomly distributed within the solar energy project.

- 100.4.5 Wildlife Research and Collection permits must be obtained by the proponent prior to conducting the post-construction monitoring because permits are required for wildlife research activities and projects that involve handling of dead wildlife in Alberta. For more information on research permits, search “wildlife research” on <http://www.alberta.ca>.
- 100.4.6 At a minimum, an annual report containing the post construction survey results and mitigation plan must be submitted to the AEP by the date specified in the post-construction monitoring plan. More frequent reporting may be requested by the AEP Wildlife Biologist.
- 100.4.7 The post-construction monitoring annual report in Standard 100.4.6 shall include the following:
- a) a detailed description of the survey methods,
  - b) the raw data, using the appropriate FWMIS datasheet for each solar collector/reflector (search for “FWMIS” at <http://www.alberta.ca>),
  - c) results of searcher efficiency trials and scavenger removal trials,
  - d) the uncorrected fatality rate for birds and other wildlife expressed as the number of mortalities/megawatt/year<sup>5</sup>,
  - e) the corrected rates of mortalities/megawatt/year as per Huso (2011) or acceptable alternative<sup>6</sup>,
  - f) a summary of the species killed and the condition of their carcass,
  - g) results of pre-construction wildlife surveys (i.e., breeding bird survey, raptor nest monitoring, etc.),
  - h) a comparison of the pre- and post-construction survey results if required as per Standard 100.4.3d (e.g., breeding bird, raptor nest monitoring), and
  - i) a statement of compliance with the Directive and the signature of the lead biologist.
- 100.4.8 When conducting post-construction monitoring, the proponent shall collect, identify, label, freeze and submit the carcasses of all species at risk and sensitive species.
- 100.4.9 Where the results of any post-construction monitoring survey demonstrates wildlife mortalities exceed acceptable or anticipated levels, operational mitigation measures as described in the post-construction mitigation plan must be implemented to reduce the risk of future fatalities. Operational mitigation options to reduce or prevent wildlife fatalities include but are not limited to: the use of bird deterrents, adding white edges to solar collectors/reflectors or increase spacing between solar collectors/reflectors, or other acceptable alternatives developed in consultation with the AEP Wildlife Biologist.
- 100.4.10 When post-construction mitigation actions are required, as per Standard 100.4.9, the proponent must conduct an additional two years of post-construction monitoring surveys following their implementation to assess their success<sup>7</sup>. If initial mitigation does not sufficiently reduce mortality,

<sup>5</sup> The uncorrected mortality rate may be used if assessing the risk of mortality at an individual site.

<sup>6</sup> AEP will use the corrected mortality rate to assess risk of mortality to birds and any other affected wildlife.

<sup>7</sup> This can be included as part of Standard 100.4.1. For example, if mitigation occurs after the first year of surveys, the total survey time will be four years, but if it occurs after the second year of post-construction surveys, the total survey time will be five years.

further mitigation and post-construction monitoring surveys will be required as prescribed by the AEP Wildlife Biologist.

- 100.4.11 Upon receipt of a written request from the AEP Wildlife Biologist, proponents will allow access and ensure that private land owners are aware of and consent to visits to the site by AEP Wildlife Biologist(s) or associated researcher(s).



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## GLOSSARY

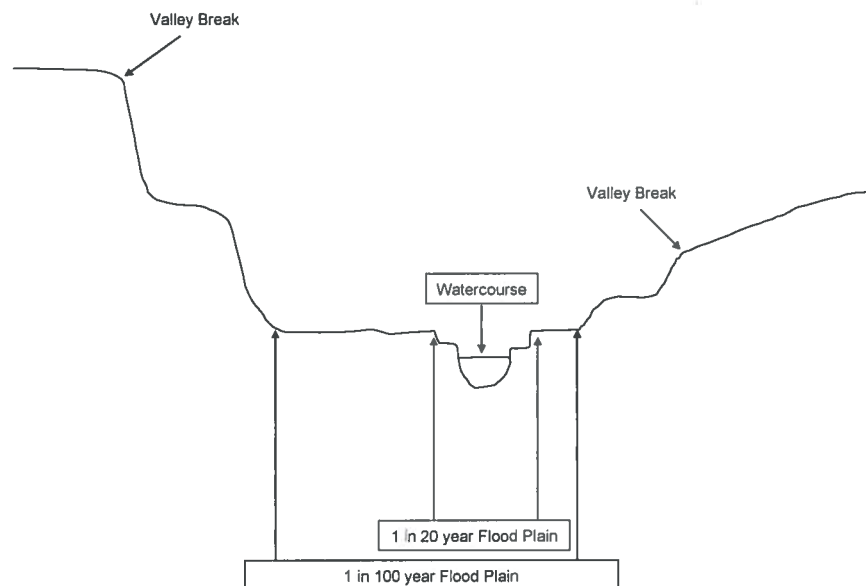
**Active House, Nest or Den** - An active house, nest or den is one that is presently being used by wildlife as confirmed through the visual presence of an animal, or the evidence of fresh feces, signs of digging/excavation, feathers, and/or tracks.

**Activities** - All solar energy project operations on the landscape, including planning, construction, operation, maintenance and decommissioning.

**Anthropogenic** - A feature or change caused or produced by humans.

**At Risk** - As defined in the *Status of Alberta Wild Species*, any species known to be 'At Risk' after formal detailed status assessment and legal designation as 'Endangered' or 'Threatened' in Alberta.

**Break (valleys)** - The point where change in slope of the ground demarks uplands from the fluvial hills dropping into a valley bottom, which includes watercourses and coulees. See diagram below.



**Buffer** - An area of vegetation maintained around a feature (distance applied to all sides of feature) to mitigate the effects of any activity applied to the area beyond the buffer.

**Burrowing Owl Nest (Active)** - A residence for two full years after the last known month of occupation by a burrowing owl.

**Coulee** - A dry stream valley, especially a long steep-sided ravine that once carried melt water from a glacier.

**Commissioning** - Once construction is complete meaning that all solar energy infrastructure is in place and ready to produce electricity.

**Construction** - The period of time that is initiated when surface soil is mechanically disturbed for the purpose of creating or erecting solar energy infrastructure and ends when the solar energy project is commissioned.

**Current Survey** - Wildlife surveys completed within two years of the last survey date.

**Disturbance** - Any alteration of the natural landscape by anthropogenic or natural processes.

**Emergency Situation** - Emergency means an event that requires prompt co-ordination of action or special regulation of persons or property to protect the safety, health or welfare of people or to limit damage to property.

**Endangered<sup>8</sup>** - As defined by the *Wildlife Act*, a wildlife species facing imminent extirpation or extinction.

**Experienced Wildlife Biologist** - AEP Wildlife Biologist Management expects that all wildlife surveys are completed by experienced trained wildlife biologists or wildlife technicians. All wildlife surveyors working in Alberta must have:

- a. The ability to positively identify target species by sight and/or sound. Multiple years of wildlife and surveying experience are preferred.
- b. Familiarity with the species biology, including habitat requirements of the species and experience in identifying the species habitat features.
- c. Familiarity with survey methods as described in the *Sensitive Species Inventory Guidelines*. Multiple years of experience is strongly recommended.
- d. Attained a Bachelor of Sciences degree in Biology, Environmental Sciences, Renewable Resources, or hold a Technical Diploma in Natural Resources or Environmental Management from a certified College.

**Fescue Grasslands** - Native grassland communities associated with the dark brown and black chernozemic soils of Alberta that are primarily located within the Foothills Fescue, Northern Fescue, Central Parkland, Foothills Parkland, Montane and Subalpine Natural Subregions. Note: the specific plant communities are described in the *Range Plant Community Guides* and can be found by searching “Range Plant Community Type Guides” at <http://www.alberta.ca>.

**Footprint** - The surface area of land disturbed from its natural condition by human activity and the associated impact to or on related natural resources.

**Fragmentation** - The breaking up of contiguous blocks of habitat into increasingly smaller blocks as a result of direct loss and/or sensory disturbance (i.e., habitat alienation).

**Frozen Construction** - Operations that occur when the ground is frozen. Conditions are dependent on local weather, rather than specific dates.

**Hibernacula** - Shelter used by hibernating animal or group of animals (i.e. snakes, bats) during the winter months.

**Infrastructure** - Any and all equipment, structures and roads that are developed for a solar energy project.

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<sup>8</sup> The federal *Species At Risk Act* has similar designations to the *Wildlife Act*, however, the individual designations afforded to a species may differ between the two pieces of legislation. It is the responsibility of the proponent to ensure they are compliant with any federal legislation.

**Integrated Land Management (ILM)** - Is the strategic planned approach to managing and reducing human-caused footprint.

**Lake Effect** - A hypothesis that suggests birds are attracted to arrays of solar collectors/reflectors because polarized light reflects off solar collectors/reflectors at a similar wavelength as water and therefore may appear to look like a lake.

**Land Capability** - The ability of land (unaltered by future management inputs, activities, or alterations) to support a given land use, based on an evaluation of the physical, chemical and biological characteristics of the land, including topography, drainage, hydrology, soils and vegetation.

**Lek** - A traditional place where male grouse assemble during the mating season and engage in competitive displays to attract females.

**May Be At Risk** - As defined in the *Status of Alberta Wild Species*, any species that 'May Be At Risk' of extinction or extirpation, and is therefore a candidate for detailed risk assessment.

**Native Grasslands** - An area of prairie in which natural vegetation consist primarily of perennial grasses. The native species composition must be greater than 30% (Adams et al. 2005).

**Nest Prevention** - Mitigation installed to prevent target species of birds (i.e. corvids) from nesting on anthropogenic features including but not limited to, solar collectors/reflectors, above-ground collection lines, substations, and invertors.

**Reclamation** - The process of returning disturbed land to its former characteristics or other productive uses.

**Right of Way (ROW)** - A cleared area, usually linear, containing a road and its associated features such as shoulders, ditches, cut and fill slopes, or the area cleared for the passage of utility corridors containing collection lines or over- or under-ground pipelines. Typically, the right-of-way is a designated area of land having specific rights of usage attached.

**Riparian** - The adjoining vegetated uplands that are directly influenced by the waterbody.

**Sensitive Raptor Active Nest** - A raptor nest will retain 'active' designation during the winter following nesting activity, through a second year, and into a third year, with the 'active' designation being dropped on June 1st of the second year of inactivity. The nest will retain 'active' designation at the discretion AEP, if no other nesting structures (trees, platforms) are available within a 1km radius of the nest.

**Sensitive Species** - Any species that is not at risk of extinction or extirpation, but may require special attention or protection to prevent it from becoming at risk.

**Sensory Disturbance** - Impacts to and disturbances from noise, light, odour or vibrations associated with human activities.

**Setback Distance** - The interval distance between a wildlife site and the edge of the nearest point of anthropogenic disturbance. For solar energy projects, setback distance is measured from the closest edge of the project footprint to the closest edge of the feature.



**Solar Energy Infrastructure** - All man-made components required to operate a solar energy project, including but not limited to solar collectors/reflectors, inverter units, substations, collection lines and roads.

**Solar Energy Project** - The inclusive term for the entire area of the solar energy project and all solar energy related infrastructure within the footprint, including solar collectors/reflectors, buildings, inverter units, collection lines, roads, laydown areas, fences, temporary work spaces, and the substation.

**Species at Risk**<sup>9</sup> - Any species identified by the *Wildlife Act* of Alberta as 'Endangered', 'Threatened' or 'Species of Special Concern' as well as any species identified in the *Alberta Wild Species General Status Listing* as 'At Risk', 'May Be At Risk' or 'Sensitive'.

**Substation** - An auxiliary power station where electrical current is converted.

**Temporary Work Space** - The use of existing clearings or the new clearing of public or private land to facilitate the construction of a disposition or operation; often called a laydown area.

**Threatened**<sup>10</sup> - As defined by the *Wildlife Act* of Alberta, a wildlife species likely to become 'Endangered' if limiting factors are not reversed.

**Urban Area** - Any location within the municipal boundaries of cities, towns and villages where subdivision development exists within 800m of the proposed facility.

**Waterbody** - Any location where water is present, whether or not the presence of water is continuous, intermittent or occurs only during a flood, and includes, but is not limited to, wetlands and aquifers.

**Watercourse** - A river, brook, stream or other natural water channel (includes ephemeral draws), including the bed along which water flows.

**Watercourse (Intermittent)** - Small stream channels with small springs being the main water source outside periods of spring runoff and heavy rainfall. They have distinct channel development usually with no terrestrial vegetation and a width of less than 0.4m and some bank development.

**Watercourse (Small Permanent)** - Permanent streams that often have small valley bottoms and bench floodplain development. Banks and channel are well defined with a channel width from greater than 0.7m to 5.0m.

**Watercourse (Large Permanent)** - Major streams or rivers with well-defined flood plains and often a wide valley bottom. The channel is usually non-vegetated and the channel width exceeds 5.0m.

**Wetland** - Land having water at, near, or above the land surface, or which is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained hydric soils, hydrophytic vegetation, and various kinds of biological activity that are adapted to the wet environment.

<sup>9</sup> The federal *Species At Risk Act* has similar designations to the *Wildlife Act*, however the individual designations afforded to a species may differ between the two pieces of legislation. It is the responsibility of the proponent to ensure they are compliant with any federal legislation.

**Wildlife** - All wild species including plants, invertebrates, and micro-organisms, as well as fishes, amphibians, reptiles, and the birds and mammals traditionally regarded as wildlife.

**Wildlife Habitat** - The terrestrial and aquatic environments and associated ecosystem elements that in combination provide the requirements of food, shelter, and space needed to support self-sustaining populations of wildlife.

**Wildlife Survey** - A comprehensive survey for all species observations and habitat features, as identified in the Landscape Analysis Tool, near the proposed area of a development, as defined by the protocols outlined in the *Sensitive Species Inventory Guidelines*.

**Ungulate** - A hoofed mammal.

## APPENDIX A – AEP Wildlife Outcomes

Wildlife Outcomes: describe the goals for various wildlife species and their associated habitat enabled through the implementation of avoidance, minimization and mitigation strategies identified in this Directive.

- A. Reduce human caused wildlife mortality.
- B. Reduce increased predation associated with anthropogenic features.
- C. Conserve and protect habitat.
- D. Maintain the ecological conditions necessary for naturally sustainable wildlife populations to exist throughout Alberta, and conserve the habitats they require.
  - i. Maintain unique and/or important wildlife habitat sites.
  - ii. Avoid or minimize development within key habitats (local and landscape scales) and key seasons.
  - iii. Maintain habitat intactness, connectivity, and allow for wildlife use, breeding and passage throughout areas by minimizing habitat loss and fragmentation.
- E. Minimize potential adverse effects of land-use activities on wildlife population health.
- F. Reduce the potential for habitat avoidance due to the presence of anthropogenic features.
- G. Decrease potential for sensory disturbance and displacement of wildlife.
- H. Limit potential for human-wildlife conflict.

## Appendix B - Migration Survey Dates for Proposed Solar Energy Projects

The following outlines the migration survey timing for solar energy projects in Alberta. Based on the information available on the impacts to birds from solar energy projects the following bird groups are to be the focus of any migration surveys for solar energy projects:

- Passerines
- Waterfowl
- Waterbirds

The dates outlined below are based on the general migration seasons for these groups of birds and may not be applicable to other avian groups (i.e. birds of prey).

Migration is dependent on a number of factors including weather and project location. Multiple surveys must be conducted during each season to ensure that data is representative of the wildlife use in an area. The dates outlined below provide general guidance on migration seasons in Alberta. However it is up to the solar energy project proponent to ensure they have adequately completed the requirements outlined in Standard 100.2.1.

Season	Time of Season	Grassland and Parkland Natural Regions	Boreal Forest, Foothills, and Rocky Mountain Natural Regions
Spring	Early	March 15th - April 15th	April 1st - April 30th
	Mid	April 1st - April 30th	April 15th - May 15th
	Late	April 15th - May 15th	May 1st - May 30th
Fall	Early	August 15th - September 30th	July 15th - August 15th
	Mid	September 15th - October 30th	August 1st - September 1st
	Late	October 15th - November 30th	August 15th - September 30th



## APPENDIX C – Setbacks and Timing Restrictions

Required setbacks and timing restrictions for wildlife and wildlife features detected at solar energy projects in Alberta. Setbacks are measured from the edge of the disturbance to the edge of the wildlife feature. The wildlife feature is measured from the edge of the nesting site for birds or the bed and shore of wetland breeding pond for amphibians. For all species not specified below, the setback is 100m from an active house, nest or den.

Species	Habitat Feature	Time of Year	Setback Distances	Comments
<b>Amphibians</b>				
Great Plains toad, plains spadefoot, northern leopard frog, boreal toad, Columbia Spotted Frog and Canadian toad	Breeding ponds	Year round	100m	This applies to any wetland class (bog, fen, marsh, shallow open water, swamp) identified in Table 1 in the <i>Alberta Wetland Classification System</i> (ESRD 2015) except for wetland classes with Water Permanence listed as Temporary in this Table.
long-toed salamander	Breeding ponds	Year round	100m	
<b>Reptiles</b>				
wandering garter snake, plains garter snake, and red-sided garter snake	Hibernacula	Year round	500m	
bull snake, prairie rattlesnake, and western hognose snake	Hibernacula	Year round	500m	Construction & upgrades of roads are of concern within habitat proximate to river valleys inhabited by snakes.
	Birthing rookeries	Year round	200m	Additional to hibernacula setback to the extent necessary.
short-horned lizard	Suitable habitat	Year round	200m	Pre-development surveys required in areas of suitable habitat. Habitat is mapped for this species.
<b>Birds</b>				
peregrine falcon, prairie falcon, ferruginous hawk, bald eagle, and golden eagle	Nesting sites	Year round	1000m	
osprey	Nesting sites	Year round	750m	
northern goshawk	Nesting sites	Year round	500m	
barred owl	Nesting sites	Year round	500m	

Species	Habitat Feature	Time of Year	Setback Distances	Comments
burrowing owl	Active den	Year round	500m	Den considered active for two full years after the last known month of occupation.
long-billed curlew, upland sandpiper, mountain plover, short-eared owl, chestnut-collared longspur, and Sprague's pipit	Active nest	Apr 1 - Jul 15	100m	
sharp-tailed grouse	Lek	Year round	500m	
greater sage grouse	Leks	Year round	3200m	Habitat is mapped for this species.
	Habitat	Year round	1000m	
American white pelican	Nesting colonies	Year round	1000m	
great blue heron	Nesting colonies	Year round	1000m	Habitat is mapped for this species.
loggerhead shrike	Nesting sites	Apr 1 - Jul 15	150m	
		Jul 16 - Apr 14	50m	
pileated woodpecker	Nesting sites	Year round	100m	
pied-billed grebe and horned grebe	Nesting sites	Apr 15 - Jul 31	1000m	
western grebe	Nesting sites	Year round	1000m	
Forster's tern	Nesting sites	Year round	1000m	
black tern	Nesting sites	Year round	1000m	
<b>Mammals</b>				
Ord's kangaroo rat	Dens	Year round	250m	All activity should conclude before sunset and not use artificial illumination within 1000m of mapped range. Larger setbacks may be recommended.
swift fox	Dens	Year round	500m	
northern myotis	Roost sites and Hibernacula	Year round	300m	
grizzly bear	Active Dens	Oct 1- Apr 30	750m	

Species	Habitat Feature	Time of Year	Setback Distances	Comments
<b>Plants</b>				
tiny cryptanthe, whitebark pine, limber pine, western spiderwort, small-flowered sand verbena, hare-footed locoweed, slender mouse- eared cress, and soapweed (yucca)	Populations	Year round	300m	Setback is measured from all detectable individuals.
<b>Features</b>				
Mineral Lick		Year round	100 m	

## APPENDIX D – Road Class Specification

All roads necessary for access to the solar energy project are required to use road classes as defined in table below.

Class	Right of Way Width	Usage Description
Class I	30 – 40m	<ul style="list-style-type: none"> <li>• All weather access. Primary corridor.</li> </ul>
Class II	20 – 30m with variable allowance for terrain conditions	<ul style="list-style-type: none"> <li>• All weather or dry weather access.</li> </ul>
Class III	<p>&lt; 20m with variable allowance for terrain conditions</p> <p>15m where terrain or other conditions allow</p>	<ul style="list-style-type: none"> <li>• All weather or dry weather access.</li> <li>• Site specific cuts and fills may be required. Right of way (ROW) width shall be the minimum required to allow travel, while addressing environmental concerns.</li> </ul>
Class IV	<p>&lt; 15m with variable allowance for terrain conditions</p> <p>Up to 20m where required for watercourse approaches (to enable water management), log decks (every 800m), corners, side slopes, and pull outs; all not to exceed 20% of the length of the route</p>	<ul style="list-style-type: none"> <li>• Low Grade, frozen or dry conditions.</li> <li>• Can be constructed and used year round when conditions are suitable.</li> <li>• Should a portion of the route become impassable due to wet conditions, drainage problems, or rutting, site specific improvements (i.e. matting, padding, culverts etc.) to the problematic area(s) may be implemented.</li> <li>• Some access improvements required to support specific site servicing work shall be temporary only and removed after the activity is over.</li> <li>• ROW width shall be the minimum required to allow travel, while addressing environmental concerns.</li> <li>• Roads will typically follow contours of the landscape more closely than do higher standard routes.</li> <li>• Drainage control and borrow material may be required on a site-specific basis.</li> <li>• Cuts and fills shall be minimized.</li> </ul>
Table continued on next page.		

Class	Right of Way Width	Usage Description
Class V	<p>10m with variable allowance for terrain conditions</p> <p>Up to 20m where required for watercourse approaches (to enable water management), log decks (every 800m), corners, side slopes, and pull outs; all not to exceed 20% of the length of the route</p>	<ul style="list-style-type: none"> <li>• Minimal disturbance – frozen or equivalent to frozen.</li> <li>• Allows for winter operations and/or emulates frozen ground access when frost conditions are not adequate or not present.</li> <li>• Access will minimize ground disturbance under non-frozen ground conditions, and will mimic frozen ground access.</li> <li>• Ground disturbance, surface vegetation disturbance, grade development, ROW clearing and surface improvements will be minimized.</li> <li>• Can be constructed and used year round; during unfavourable ground conditions cessation of use or mitigation measures are required.</li> <li>• Road width will be minimized wherever possible by sharing space with pipeline ROWs, seismic lines and through the use of vehicle pullouts.</li> <li>• Route construction may not be feasible for all terrain conditions. A combination of padding, geo-textile, matting, road culverts, corduroy or other drivable surfaces may be required during non-frozen ground conditions.</li> <li>• Gravel may be used in site-specific situations for safety or environmental protection of water crossings, but its use shall be minimal.</li> </ul>
Class VI (Prairie and Parkland)	< 15m, with variable allowance for terrain conditions	<ul style="list-style-type: none"> <li>• Minimal disturbance – dry or frozen ground.</li> <li>• Ground disturbance, surface vegetation disturbance, grade development, ROW clearing and surface improvements shall be minimized. No grading shall occur.</li> <li>• Can be constructed and used year round; during unfavourable ground conditions cessation of use or mitigation measures are required.</li> <li>• May require adjustments to access schedules, and require use of alternative vehicles for site monitoring.</li> <li>• Road width shall be minimized, wherever possible, by sharing space with pipeline ROWs, or other existing linear disturbances.</li> </ul>



## APPENDIX E – Access Control and Management

1. Access control techniques are intended to restrict unauthorized access of vehicles. Where access control is required, the control measures identified below shall be effective, maintained, and monitored. Control measures may include one or more of the following:

- earthen berms
- permanent or temporary removal of water crossing structures
- barricades
- locked gates
- manned checkpoints
- road security patrols
- treed buffers
- re-vegetation
- de-compaction
- roll-back
- pre-existing access control

The proponent will select an appropriate access control method to limit both highway and off-highway vehicles from accessing the site.

2. Signage should accompany all access control measures. Sign must be located at a visible spot at least 1.5m off the ground and not be obscured by plowed snow or vegetation.
3. When gates are used for access control, the following conditions shall apply:
  - a. Locked gates shall be constructed at locations and in a manner which will contribute to their effectiveness in preventing access to the road (in combination with applying public access restrictions).
  - b. Gates shall remain closed and locked at all times. The gate may only be opened to allow for the passage of an authorized vehicle.
  - c. Locks shall be placed in a structure that is designed to protect them from being broken.
  - d. As locks are lost or destroyed, they will be replaced within 72 hours of the disposition holder being aware of the need.
  - e. Gates will be designed to ensure that passage of a 4x4 on-highway vehicle is restricted. This may include the use of barrier rock, berms, ditches, placement of the gate before a bridge or other impediments to travel around the gate. All gates will be installed in such a manner that a safety hazard is not created.
  - f. Use of combination locks is required. Where this is not possible and keyed locks are used, double locking using a regulatory body lock is required. (Double locking refers to a company lock and a regulatory body lock on the same gate, allowing each party to pass using their own keys).
  - g. Disposition Holders will only make combination lock changes with prior confirmation from the issuing regulatory body staff in charge.

## APPENDIX F – Alberta Bear-Human Conflict Management Plan for Camps

These practices are recommended for establishing or operating a camp in bear season, from April 1st to November 30th.

### Purpose

1. To reduce bear-human conflicts and enhance safe working environments (compliance with Alberta's Occupation Health and Safety Regulations) by reducing or eliminating attractants for bears and creating barriers to prevent bear access to camps.
2. To help industries to comply with the *Wildlife Act* and ensure that industries operating in bear country handle garbage, food, cooking areas and other attractants appropriately.
3. To ensure the conservation of black and grizzly bears.

The applicant is responsible for appointing a main contact person for all bear concerns on the disposition. It is recommended that the Safety Officer or the person appointed to oversee camp operations be the main contact. This person is responsible for responding to all inquiries about bear concerns before contacting AEP, to ensure that concerns are verified, any unsafe worksite practices are identified (including employees feeding bears) and immediate preventive actions are implemented. If an Alberta Fish and Wildlife Officer responds to a verified complaint or concern by the company contact person, the Officer may direct the implementation of additional management practices (e.g., fencing). Any direction will be in writing either as a recommended operating Standard or as an order pursuant to the *Wildlife Act*.

**All bear encounters shall be promptly reported to the local Alberta Fish and Wildlife District Office by calling 310-0000. In an emergency situation, workers should call 1-800-642-3800. All grizzly bear sightings at a camp shall be reported immediately to local Solicitor General Fish and Wildlife Officer or an AEP Wildlife Biologist.**

### A. Long-term Industrial Camps

1. Use bear-resistant garbage containers. Wood containers are not considered bear resistant unless they are reinforced with metal. All lids shall be kept secured and closed when not being loaded.
2. Use bear-resistant garbage-containment receptacles (large bins).
3. Use totally enclosed bear-resistant black water containment with disposal at an approved facility.
4. Use bear-resistant secure cooking grease storage containment. Lids shall be kept closed when not being loaded and the exterior shall be kept clean.
5. At worksites not enclosed by a perimeter fence, waste food and food containers/wrappers are to be disposed of in garbage containers in secure buildings or in bear-resistant containers and transferred to bear-resistant garbage containment receptacles at least daily prior to nightfall.
6. No waste disposal or waste storage facilities in camp or work area parking lots that are not within a fenced area.
7. Where parking lots are not encompassed by a fence, signs shall be posted in those lots advising workers not to litter and to remove all waste from vehicles and dispose of it in waste containers within the enclosed camp area.
8. In response to bear occurrence, the presence of bear attractants, and/or bear-human conflict at a location, the following Standard may be required following direction from an Alberta Fish and Wildlife Officer:
  - a. All garbage containment areas and waste water containment facilities shall be encompassed by a permanent two-metre chain-link, or game-proof fence with:
    - i. Three strands of barbed wire on top surrounded by a four-strand electrified fence complete with electrified gate access, or

- ii. A seven-strand wire electrified fence complete with electrified gate access.
- iii. Fence and gate electrified function shall be tested daily and a two-meter vegetation control buffer maintained on all sides of the fence.

**B. Seasonal Long-term Camps (one April 1st to November 30th bear season)**

1. Bear-resistant garbage containers. Wood containers are not considered bear resistant unless they are reinforced with metal. All lids shall be kept secured and closed when not being loaded.
2. Use bear-resistant garbage-containment receptacles (large bins).
3. Totally enclosed bear-resistant black water containment with disposal at an approved facility.
4. Bear-resistant secure cooking grease storage containment. Lids shall be kept closed when not being loaded and the exterior shall be kept clean.
5. At worksites not enclosed by a perimeter fence, waste food and food containers/wrappers are to be disposed of in garbage containers in secure buildings or bear-resistant containers and transferred to bear-resistant garbage containment at least daily prior to nightfall.
6. No waste disposal or waste storage facilities in camp or work area parking lots that are not within a fenced area.
7. Where parking lots are not encompassed by a fence, signs shall be posted in those lots advising workers not to litter and to remove all waste from vehicles and dispose of it in waste containers within the enclosed camp area.
8. In response to bear occurrence, the presence of bear attractants, and/or bear-human conflict at a location, the following Standard may be required following direction from an Alberta Fish and Wildlife Officer: All garbage containment areas and waste water containment facilities shall be encompassed by a seven-strand wire electrified fence complete with electrified gate access. Fence and gate electrified function shall be tested daily and a two metre vegetation control buffer maintained on all sides of the fence.

**C. Short-term Temporary Camps (less than one April 1st to November 30th bear season)**

1. Bear-resistant garbage containment with secure lids that shall be kept closed when not being loaded.
2. Garbage containment receptacles (large bins) housed off-site.
3. Totally enclosed bear-resistant black water containment.
4. Bear-resistant secure cooking grease storage containment. Lids shall be kept closed when not being loaded and the exterior shall be kept clean.
5. Non-food attractants such as greases and oils that are kept at worksites are to be kept in bear-resistant storage such as hard-walled buildings, fuel sheds or strong boxes.
6. At worksites not enclosed by the perimeter fence, waste food and food container and wrappers are to be disposed of in garbage containers in secure buildings or in bear-resistant containers at outdoor work sites and transferred to bear-resistant garbage containment daily prior to nightfall.
7. In addition to the above, the following management practices shall be added where accommodations are in soft-walled structures:
8. Locate camps in open areas with good visibility and at least 200m away from bear food sources (such as berries).
9. Keep sleeping areas away from cooking and eating areas.
10. Clean cooking and eating areas after eating and place food or dispose of waste in appropriate containment.
11. Store all food indoors in bear-resistant containers or a hard-walled structure or trailer.
12. Cook and eat in a central area or structure.
13. Inspect the camp daily for bear attractants and minimize or eliminate.
14. In response to bear occurrence, the presence of bear attractants, and/or bear-human conflict at a location, the following Standard may be required following direction from an Alberta Fish and Wildlife Officer:

- a. Four-strand electrified fence complete with electrified gate access encompassing all garbage containment areas, wastewater containment, cooking facilities and accommodation facilities. Fence and gate electrified function shall be tested daily and a two metre vegetation control buffer maintained on all sides of the fence.

Original signed by:

Date: October 4, 2017

Name of approver: Travis Ripley, Executive Director

Program/branch name: Fish and Wildlife Policy, Policy and Planning Division  
Environment and Parks

