
Report

Teanaway Solar Reserve Wildlife Mitigation Plan Kittitas County, Washington

Prepared for
Teanaway Solar Reserve, LLC

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Prepared by
CH2MHILL



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1.0 Introduction

Teanaway Solar Reserve, LLC (TSR) submitted a Conditional Use Permit (CUP) and Expanded State Environmental Policy Act (SEPA) Checklist for the proposed project to Kittitas County on August 18, 2009. The application was deemed complete by the County on September 3, 2009. The public comment period on the CUP/SEPA ended on October 5, 2009. Comments were received from various state agencies and interested local parties. Comments were raised pertaining to the potential for the proposed project to impact elk habitat and migration. TSR prepared this technical memorandum in response to the public comments.

The purpose of this technical report is to assess the potential impacts to elk, elk habitat, and migration corridors associated within the proposed project area and to present options for mitigation measures to offset the potential impacts.

2.0 Project Background

TSR proposes to construct and operate the project on approximately 982 acres of private land within the Forest and Range (F&R) zoning district in an unincorporated area of Kittitas County, Washington (see Appendix A, Figure 1). The project will generate up to 75 direct current megawatts (MWdc) of photovoltaic (PV) solar energy utilizing approximately 477 acres of land within the proposed project area.

The purpose of the proposed project is to generate up to 75 MWdc of PV solar energy for distribution to utilities and communities seeking to optimize their renewable and sustainable energy sources. The project was conceived in response to the growing importance of and need for sustainable energy sources and the State of Washington's Renewable Electricity Standard, Revised Code of Washington (RCW) Title 19, mandate that by the year 2020, the state's largest electric utilities meet 15 percent of their retail electric load with renewable electricity (for example, wind and solar energy). The standard first takes effect in 2012 with a requirement of 3 percent through 2015, then 9 percent from 2016 through 2019 and 15 percent thereafter.

Oregon and California have adopted similar standards. Depending on the commercial terms available for the power sales, the utilities that may buy power from the project could change over time.

TSR proposes to develop the site to maximize its solar energy potential, based on its commitment to providing renewable energy and becoming the leading (in terms of energy production and environmentally sensitive development and management of its solar production site) sustainable energy production location in North America. The following factors have been analyzed to determine optimal location within the site:

- Significant solar radiation (insolation)
- Site accessibility
- Avoidance and minimization of impacts to environmentally sensitive areas
- Limited visibility from offsite locations

The proposed project will consist of the following key components (see Figure 4 in Attachment J, *Figures*):

- Solar modules
- Field inverters
- Field transformers
- Electrical conductors
- Electrical substation and switchyard
- Operations and maintenance (O&M) building supervisory control and data acquisition (SCADA) system
- Overhead interconnection transmission line
- Access and maintenance roads

Site preparation will consist of clearing the existing vegetation only in those areas where construction, grading and road improvements will occur. Site preparation will be limited to maintenance roads, the O&M facility, the substation, and the solar facility. Once the site is prepared, the installation of foundations, trackers, modules, inverter pads and enclosures, and substation foundation can begin (CH2M HILL, 2009a).

3.0 Existing Site Conditions

The proposed project area is located on Cle Elum Ridge (elevations ranging from approximately 2,200 to 2,600 feet). Due to its higher elevation, snow accumulation is greater here than in neighboring lowland habitats located to the northeast. Snowfall for Cle Elum, Washington (elevation 1,930 feet) averages 86.5 inches per year (USDA NRCS, 2002). Based on landowner comments, snow depth varies from year to year along the Cle Elum ridge.

The site is currently zoned F&R (see Figure 6 in Attachment J, *Figures*). Since the early 1900s this site has been repeatedly selectively logged. Harvests have occurred in the 1920s, 1950s, 1980s, and 2000s. Pre-commercial thinning occurred in the decades between logging. Prior to 1900 the site had a fire frequency of 9 to 12 years, indicating that a healthy understory and small trees did not exist, creating a park-like stand of larger trees that were fire resistant to low intensity periodic fires. The site was most recently selectively logged in 2001 and existing site vegetation consists of low grasses, shrubs, and plants with scattered 50- to 60-foot, 6- to 18-inch-diameter ponderosa pine (*Pinus ponderosa*) trees. Shrub and riparian plant communities are predominantly snowberry (*Symphoricarpos albus*) and Rose (*Rosa spp.*) bushes. Herbaceous plant communities are predominantly Lupine (*Lupinus seiceus*), yarrow (*Achillea millefolium*), arrowleaf balsamroot (*Balsamorhiza sagittata*), and various grass species. Wetland plant communities are dominated by rushes (*Juncus spp.*), sedges (*Carex spp.*), wild onion (*Allium douglasii*), and various grass species (see Appendix E for site photographs).

All streams and wetlands observed during site reconnaissance in early June 2009 were dry within the upper 20 inches, with the exception of a pond (W12) located in the southwest corner of the proposed study area (CH2M HILL, 2009b). No snow was observed along the top of Cle Elum ridge during June surveys.

CH2M HILL biologists conducted reconnaissance-level surveys for rare plant and wildlife species throughout the area. The purpose of the surveys was to identify potential

populations of special status species and to determine whether proposed project activities will affect these populations. The reconnaissance level surveys identified 81 plant species, 12 wildlife species, and 5 habitat types on the site. During field surveys in June 2009, six cow elk were observed in forested areas near the northwest boundary of the proposed project area. No state or federally listed endangered or threatened species were observed in the survey area during field surveys. Three habitat types in the survey area, Upland Aspen, Riparian, and Herbaceous Wetlands, are considered Washington Priority Habitats (Aspen Stands, Riparian, and Freshwater Wetlands). Because these habitats comprise only a small portion of the survey area, direct impacts to these habitats from construction and operation of the project will be avoided. Indirect impacts on wildlife habitat function would likely occur in situations where a freshwater wetlands and streams are avoided but surrounded by solar panels. The approximately 0.2 acre upland aspen stand is located in the southwest corner of the project site and is more than 200 feet from the edge of any proposed solar facilities.

4.0 Available Elk Literature and Data

TSR coordinated with local researchers and state agencies in an attempt to compile data and studies regarding the effects of solar facilities on large game, in particular elk. Information regarding elk use of the proposed project area is limited and, in some cases, contradictory.

4.1 Colockum Elk Herd

The proposed project area is within the area occupied by the Colockum elk herd (see Figure 2 in Appendix A). The Colockum elk herd range covers over 1,600 square miles between the Columbia River to the east and the Cascade crest to the west and U.S. Highway 2 to the north and Interstate 90 (I-90) to the south (WDFW, 2006) (Figure 2). The proposed project area is located within the western portion of the Colockum elk herd range where approximately 15 percent of the herd use 614,450 acres occurs (Figure 2). The proposed project area represents 0.0016 percent of the 614,450 acres.

According to the Colockum Elk Herd Plan, developed by WDFW and included here as Appendix D, the majority of elk summer in the Naneum, Swauk, and Teanaway drainages. The eastern edge of the proposed project area is located within the Teanaway drainage. The Naneum and Swauk drainages are located approximately 5 and 12 miles to the east of the proposed project area, respectively. Some of the Cle Elum elk may migrate north in the summer, but surveys and casual observations suggest the majority do not make long movements (WDFW, 2006). Other landowner observations state that the large herds of elk move to higher elevations along the Cle Elum Ridge in June and return in October (see Appendix C).

Although no elk migration studies have been conducted within the proposed project area, most Colockum elk display distinct seasonal migration patterns (WDFW, 2006). They generally move northwest to higher elevations during the summer (Bracken and Musser, 1993). With the progression of winter, snow accumulation causes elk to move southeast and use more arid, lower-elevation ranges, including lowlands adjacent to the Teanaway River (WDFW, 2002 and WDFW, 2005). The Teanaway River is located approximately 1 mile east of the proposed project area. Bracken and Musser (1993) estimated 90 percent of the

Colockum elk winter in an area bounded by Colockum Creek, the Columbia River, Rocky Coulee, and the 1,281-meter (4,200-foot) elevation contour west to Naneum Creek. Small subherds also winter near Cle Elum, between Peshastin and Colockum Creeks, and along the Wenatchee River (WDFW, 2006). These winter ranges are located approximately 12 miles east of the proposed project area.

WDFW rated summer foraging habitat in elk management areas adjacent to the Cle Elum ridge as being in fair to good condition (WDFW, 2002). Studies indicate that foraging habitat for elk will continue to decline in Washington as private and public forests are being managed for old growth establishment (WDFW, 2002). Clear cutting practices create openings where food plants preferred by elk grow in abundance. In contrast, the closed canopy typical of old growth forests limits the abundance and diversity of browse plants. The proposed project site is currently zoned F&R; it was most recently selectively logged in 2001 and existing site vegetation consists of low grasses, shrubs, and plants with scattered 50- to 60-foot, 6- to 18-inch-diameter ponderosa pine (*Pinus ponderosa*) trees.

A population objective of 4,275 to 4,725 animals was identified for the Colockum elk herd in the Game Management Plan (WDFW, 2006). Since 2001, the number of animals estimated on the surveyed winter range has declined. The February 2006 estimate on the surveyed winter range was 3,145 to 3,465 elk. The survey data suggests a declining trend since 1995, but wide variances for estimates prior to 2000 make analysis difficult.

4.2 Elk Use in the Vicinity of the Proposed Project Area

4.2.1 Washington Priority Habitats and Species and WDFW

According to Washington Priority Habitats and Species (PHS) data, no critical areas or habitat for elk exist within the proposed project area (WDFW, 2009). Elk habitat is shown to the northeast of the proposed project area, across the Teanaway River. This likely represents known winter range because the area is at lower elevation and is south-facing. Mark Teske of WDFW states, "The location of the proposed solar reserve is a location that WDFW would submit for designation as a critical area and a habitat of local importance for wintering deer and elk. Currently, Kittitas County code recognizes winter range only on public lands."

Based on phone conversations with WDFW Biologist Gary Koehler, elk inhabit forested areas east of the project area on south-facing slopes along the Teanaway River in the winter and avoid the higher elevation portions of the Cle Elum ridge where the proposed project is located and the snow is deep in the winter. Koehler stated that elk can be anywhere on the ridge, but prefer the lower ridge slopes, especially the east side (south face) slopes facing the river (Koehler, 2009). Elk in the proposed project area likely migrate to lower-elevation habitats located along the Teanaway River in October (WDFW, 2009a). Mark Teske/WDFW stated that the proposed project area is a habitat of local importance for wintering deer and elk (Teske, 2009).

In the Teanaway drainage, to the east of the project area, elk typically move onto irrigated hay (timothy, alfalfa) fields in August as the range dries, and stay in the area through fall if permitted. In the winter, as snow depth builds, haystack damage can be a problem as a result of elk. In the southern portion of GMU 335, some individuals are feeding elk and

encouraging animals to reside next to agricultural fields that elk damage. Local Teanaway farmers and ranchers have reported recent increases in elk populations (WDFW, 2006).

4.2.2 Local Landowner Observations

Elk have been reported by landowners to occupy the northeast corner of the proposed project area along south facing slopes (see Appendix C). Reported elk movements in this area coincide with research that suggest elk often travel parallel to ridgelines and sometimes along stream drainages (Kie et al., 2005).

4.3 Elk Food and Cover Requirements

In spring and summer, when food is plentiful, elk are mainly grazers – eating grasses, sedges, and a variety of flowering plants. In fall, elk increasingly become browsers, feeding on sprouts and branches of shrubs and trees, including conifers as a last resort when snow covers other plants. During fall and winter, elk continue to eat grasses when these are available and not covered by deep snow. Elk require a mix of open meadow habitat for foraging, and dense stands of mature forest for thermal regulation, shelter, and hiding cover. Foraging habitat is usually composed of open areas with less than 40 percent tree canopy closure.

Elk are hardy animals that have few physiological needs for cover. They do, however, use cover during extreme weather, to assist with thermoregulation on sunny winter days, to avoid hunters, or when they are harassed. Cover also conceals newborn calves from predators. Hiding cover is used year round but is critical during calving, the first months of a newborn calves life, and during the hunting season. Elk typically use hiding cover when resting. Adequate cover consists of vegetation patches that will conceal 90 percent of a standing elk's body at a distance of approximately 200 feet or less. Thermal cover is most often used during the winter to moderate extreme temperatures. Forest stands typically consist of trees 40 feet or more in height, with 70 percent or greater canopy closer. Ideal elk habitat includes productive grasslands, meadows, or clear cuts, interspersed with closed-canopy forests. Research has found that elk avoid using clearings over 1,200 feet wide due to the lack of immediate cover (World Forestry Center, 1992).

4.4 Elk Avoidance of Roads

Elk avoidance of roads has been documented in many studies throughout the West (Lyon, 1979 and 1983; Perry and Overly, 1976; Rost and Bailey, 1979; Ward et al., 1973). Human presence along roads displaces big game species such as elk as well as other species sensitive to human presence from otherwise useable habitat, especially during the day. Elk in Montana prefer spring feeding sites away from visible roads (Grover and Thompson, 1986) and both elk and mule deer in Colorado prefer areas greater than 660 feet from roads during the winter (Rost and Bailey, 1979). Lyon (1983) studied the effects of roads on elk distribution and habitat use. He reported that within blocks of available elk habitat, road densities of only 2 miles of primitive (undeveloped) road open to vehicle traffic per square mile resulted in elk displacement from over 50 percent of the available habitat in the areas with roads present. The avoidance was due to human disturbance and the resulting lack of security for the elk.

5.0 Effects of the Proposed Action

Potential impacts on elk, and elk habitat associated with construction and operation of the proposed project includes removal and loss of habitat associated with clearing vegetation communities and construction activities. The primary effect from project construction would be the fragmentation, alteration, and removal of elk habitat. Due to the lack of knowledge regarding the potential impacts of solar energy development on elk, it is difficult to predict with certainty the effects of the proposed project on elk. The potential effects of the proposed project on elk is summarized below and was based on a thorough understanding of the proposed project and a review of the existing scientific literature and best available science on the habitat and migration preferences of the species.

Approximately 477 acres of potential habitat will be utilized within the proposed 982-acre project area. Solar arrays will be placed on approximately 399 acres. The 477 acres is considered a direct impact that will last the duration of the project. The literature and best available science suggest that elk behavior may be adversely impacted indirectly within an additional 312 acres by project developments and human activity. Therefore, the direct and indirect impacts resulting from the proposed project will occur within 789 acres of the 982-acre project area. The remaining 193 acres will be preserved as onsite habitat mitigation for the term of the lease (see Appendix A, Figure 3).

During construction, elk would likely avoid the site due to disturbance associated with construction equipment and other human activity. Construction-related disturbance is expected to be limited to the construction period time frame. Clearing vegetation would eliminate and modify existing elk habitat. Such impacts on habitats would displace and/or eliminate elk that currently depend on this vegetation. Once vegetation has been removed, elk displaced into adjacent habitats may be unsuccessful in colonizing nearby suitable habitats because these areas could already be occupied. The increased stress of competition for limited resources and susceptibility to predation may cause displaced animals to perish or to displace other individuals that in turn may perish. Elk currently using the project area would be adversely affected by this loss of habitat

There are very few estimates of carrying capacity for herbivores in the literature because they can fluctuate two- to threefold on an annual basis due to changes in precipitation, which directly effects growth of vegetation (Edge, 2009). Therefore, it is difficult to accurately determine how the loss of foraging habitat due to the placement of the solar panels will impact on the Colockum elk herd. Based on the lack of shelter (sparse tree canopy), and relatively high elevation (2,200 to 2,600 feet), the 982-acre proposed project area may be interpreted as being less suitable winter elk habitat than surrounding areas that contain denser tree stands (not recently logged), and lower elevations where less snow accumulates.

Phillips et al. (2001) documented that high disturbance levels during the elk calving season, decreased productivity by 27 percent (WDFW, 2002). The proposed project area occurs approximately 3 miles southeast of mapped elk calving areas. During project construction, quality wintering, calving, and migration corridor habitat typically associated with elk (river bottom, floodplain, riparian, and forested upland habitat) will not be disturbed.

However, as indicated earlier, elk avoidance of roads due to human disturbance is well documented. This type of disturbance would be greatest in more open areas of the project area where line-of-sight distances are longer and escape cover is limited. Lyon (1983) reported that within blocks of available elk habitat, road densities of only 2 miles of primitive (undeveloped) road open to vehicle traffic per square mile resulted in elk displacement from over 50 percent of the available habitat in the areas with roads present. The 982-acre project area includes about 7 miles of existing roads, or 4.5 miles of roads per square mile. This is more than double the road density cited by Lyon (1983) that displaced elk from over 50 percent of the available habitat in the areas with roads present. Additional new roads would be constructed and maintained. Therefore, elk would likely be displaced from those parts of the project area where humans perform daily maintenance and security operations. Displacement from a buffer area around human activity would also occur.

At the completion of construction, spacing between solar panels, open travel corridors and access to existing wetlands, and native plant revegetation may permit elk the opportunity to graze and traverse areas within the proposed project's boundaries at night when humans are absent. Elk were observed grazing, resting and walking, with few observations of running or alarmed behavior at the Wild Horse Wind and Solar Facility during the first year of post-construction monitoring. Elk were observed on ridges and or in ravines and near turbines, or directly underneath turbines (Erickson et al., 2008).

5.1 Proposed Impact Avoidance and Mitigation Measures for Wildlife and Habitat

5.1.1 Measures Intended to Avoid and Minimize Impacts

The proposed design of the project incorporates numerous features to avoid and/or minimize impacts on elk and elk habitat. These features are based on site surveys, experience at other similar projects, and recommendations from consultants, agencies, and experts performing studies at the site. TSR has reached an agreement with WDFW on mitigation measures, as outlined in the settlement agreement in Appendix G. Features of the project that are designed to avoid or minimize impacts on elk and elk habitat include:

- Ongoing coordination with agency, and private landowner's will be pursued to find ways that further minimize TSR-related impacts to the Colockum elk herd and enhances elk habitat within the vicinity of the TSR project area.
- The project footprint is designed to avoid possible migration routes identified by landowners and densely forested winter habitat along the Teanaway River corridor in an effort to minimize impacts to elk movement.
- No project facilities will be placed within any riparian corridor, wetland, or stream, essentially leaving these areas undisturbed for elk forage and movement use. However, the narrow width of these areas and the fact that they would be surrounded by the solar array would likely limit use by elk.
- Artificial lighting will be directed toward project facilities to avoid light disturbance to surrounding wildlife mitigation areas and potential wildlife corridors.

- TSR has been designed to use existing transmission corridors and roads to the maximum extent possible. Linear facilities (such as collector cable routes, transmission line routes, or access roads) will be located in or adjacent to existing disturbed corridors in order to minimize project footprint, habitat fragmentation, and habitat degradation.
- Electrical conductors between solar modules will also be installed underground to minimize impacts to elk movements. Electrical conductors from the array field to the field inverters will be supported above-ground within the solar module framework and installed per National Electrical Code standards. Collector lines between the field transformers and the substation will be below grade.
- Overall site selection will avoid all areas with documented endangered, threatened species.
- Following joint recommendations from USFWS and WDFW, no fencing will be erected along the project boundary (Draft Meeting Notes, 2009). Both agencies raised concerns in a July meeting regarding maintaining access to important elk calving and foraging habitats and migratory corridors on the TSR.
- A planned solar panel located between the two major solar array fields in the southwest portion of the project area was removed to allow local elk movement between the two major arrays.
- The proposed project site will be restored to approximate or improved pre-project conditions including removal of solar modules and infrastructure when the project ceases operation. Surrounding lands with similar habitat will be used as reference sites to guide restoration.
- Protect all trees, shrubbery, and other vegetation not designated for removal from damage during project construction.
- Install filter bags, sediment fences, sediment filter fabric traps, and graveled construction accesses as necessary for erosion control.
- Prepare and implement a Stormwater Pollution Protection Plan (SWPPP)
- Reseed all areas temporarily disturbed by construction activities, as agreed upon with landowners or as required to meet elk habitat goals. Where installed, sediment fences and check dams will remain in place until the affected areas are well vegetated and the risk of erosion has been eliminated.
- During project construction, vehicle servicing and refueling will occur offsite in a temporary staging area equipped for fuel or oil spills.
- Onsite vehicles will be monitored for petroleum leaks.
- Spills will be cleaned up immediately upon discovery and reported to the appropriate agency.
- Any hazardous waste material generated by project construction or operation will be disposed of in a manner specified by local and state regulations or by the manufacturer. Concern has been expressed by WDFW that the panels may contain hazardous

materials. TSR contacted the manufacturer regarding the contents of the panels and a response letter from REC Solar is included as Appendix F.

- Cleanup materials will be kept readily available onsite, either at the equipment storage area, O&M building or on the construction contractor's trucks.
- Speed limits on access roads will be reduced to 20 miles per hour in order to minimize vehicle strikes.

5.1.2 Proposed Mitigation Measures

The *Washington Department of Fish and Wildlife Wind Power Guidelines* (WDFW, 2009c) suggest two fundamental mitigation approaches for mitigating permanent impacts to habitats by wind energy projects: Mitigation "by fee" and, secondarily, acquisition of replacement habitats. The project will permanently impact 477 acres of Class II habitat, requiring a mitigation value of 2:1, or 954 acres, under the Guidelines. Approximately 193 acres of the remaining 505 undeveloped acres within the project area will be considered mitigation habitat. Accordingly, the Guidelines require that TSR provide mitigation for 761 acres through fee or habitat acquisition ("Mitigation Obligation").

Consistent with the Wind Power Guidelines (WDFW, 2009c), TSR may satisfy its Mitigation Obligation either by purchasing mutually acceptable mitigation habitat and deeding it to WDFW or a mutually acceptable third party, contributing money to a mutually acceptable third-party that owns or will purchase mitigation habitat, or by paying to WDFW a fee of \$1450.00 per acre in lieu of other offsite mitigation. WDFW and TSR agree that in utilizing any of the proceeding approaches for TSR to satisfy its Mitigation Obligations, proximity and similarity of the mitigation habitat to the habitat permanently impacted by the project shall be a priority. If TSR has not satisfied its Mitigation Obligation prior to commencing construction, TSR will provide a letter of credit to WDFW in an amount sufficient to provide financial security for its obligation. TSR will be required to satisfy its Mitigation Obligation prior to commencing commercial operation of the project. A Settlement Agreement has been drafted and is pending review by WDFW. Once WDFW review and approval is received, this Settlement Agreement will be mailed to Kittitas County to be included as part of the record. A placeholder for the Settlement Agreement is included as Appendix G to this document.

5.1.3 On-Site Mitigation

TSR proposes to protect, for the life of the project, one Category II area of similar elk habitat within the proposed project area. This privately owned parcel, approximately 193 acres in size, is located in the northeastern portion of the proposed project area. The proposed mitigation area is adjacent to the largest wetland complex and only perennial water source within the proposed project area, allowing elk access to water (Figure 3). This proposed area was chosen based on discussions with WDFW personnel and a review of WDFW guidelines for appropriate mitigation for elk habitat (Harvester, 2010).

Several existing roads located within the northeast parcel which are not used to access WDNR property, will be restricted for general use to minimize human impacts on elk. Elk use of lands adjacent to the TSR project area would also be restricted to some degree by daily human presence and activity within the TSR project area. This would increase the

effective size of the impact area by limiting the value of existing habitat and any habitat enhancement actions within several hundred feet of the project area. Therefore, a visual barrier will be planted and maintained along the northern boundary that will consist of local native trees and shrubs.

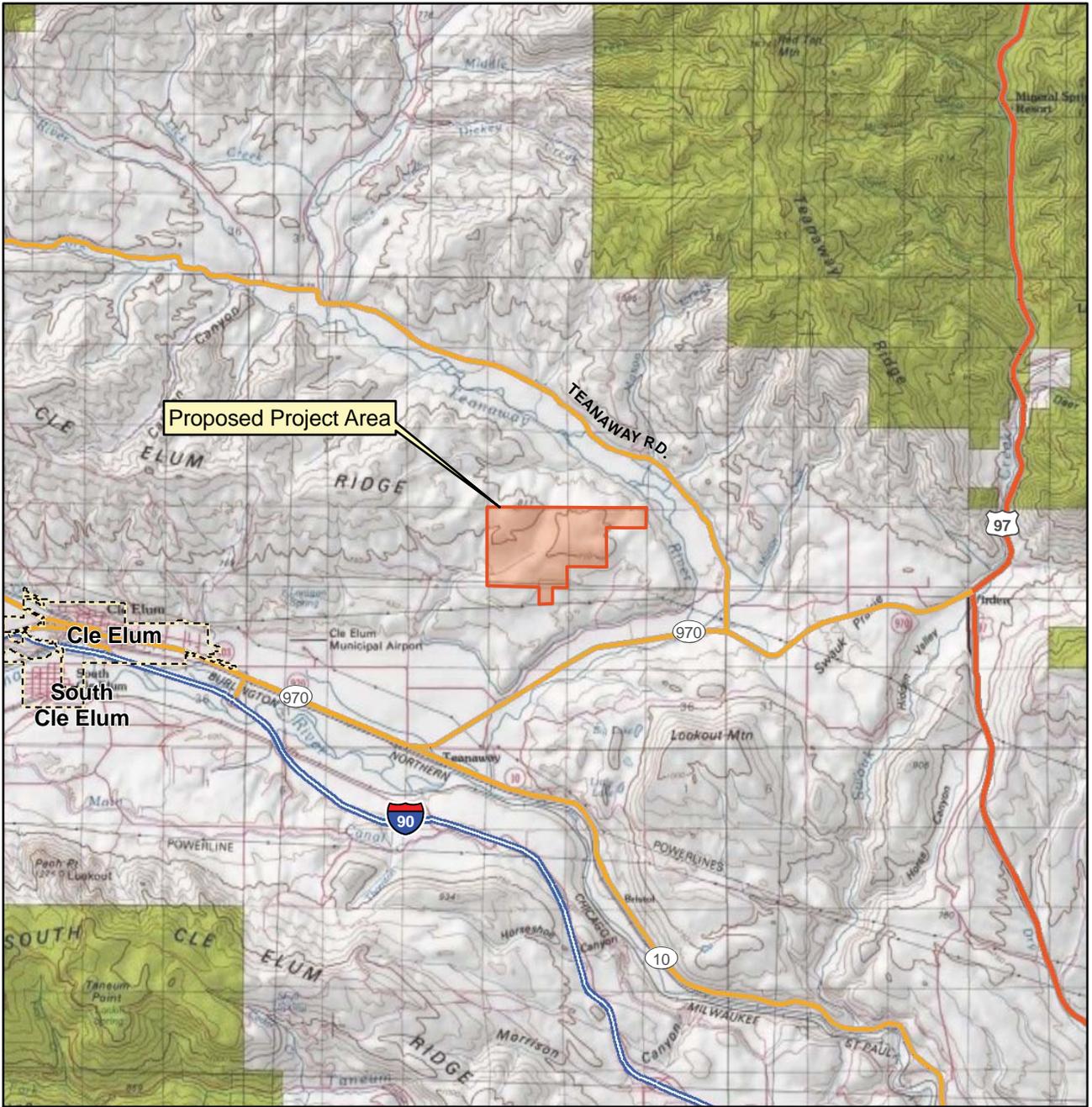
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- World Forestry Center. 1992. Woodland fish and wildlife: managing small woodlands for elk. Woodland Fish and Wildlife Project Publication.
<http://www.woodlandfishandwildlife.org/>

APPENDIX A
Figures



VICINITY MAP

LEGEND

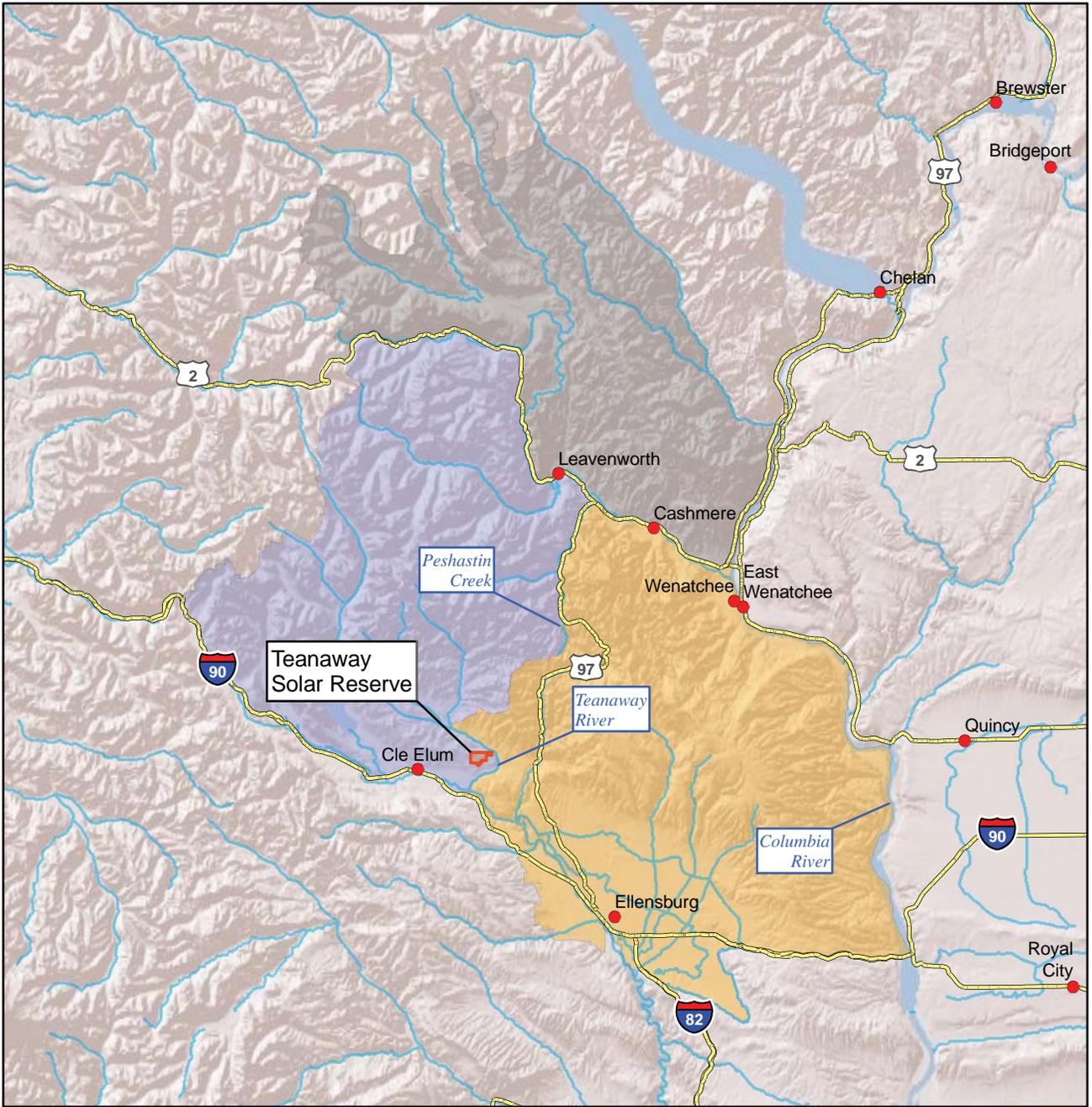
-  Proposed Project Area
-  City Boundary
-  Interstate
-  Highway
-  Major Road

Note:
1. USGS 100K Quadrangle: Wenatchee.



FIGURE 1
Vicinity Map

Wildlife Mitigation Plan
Teanaway Solar Reserve
Kittitas County, Washington



VICINITY MAP

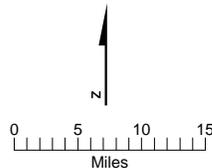
LEGEND

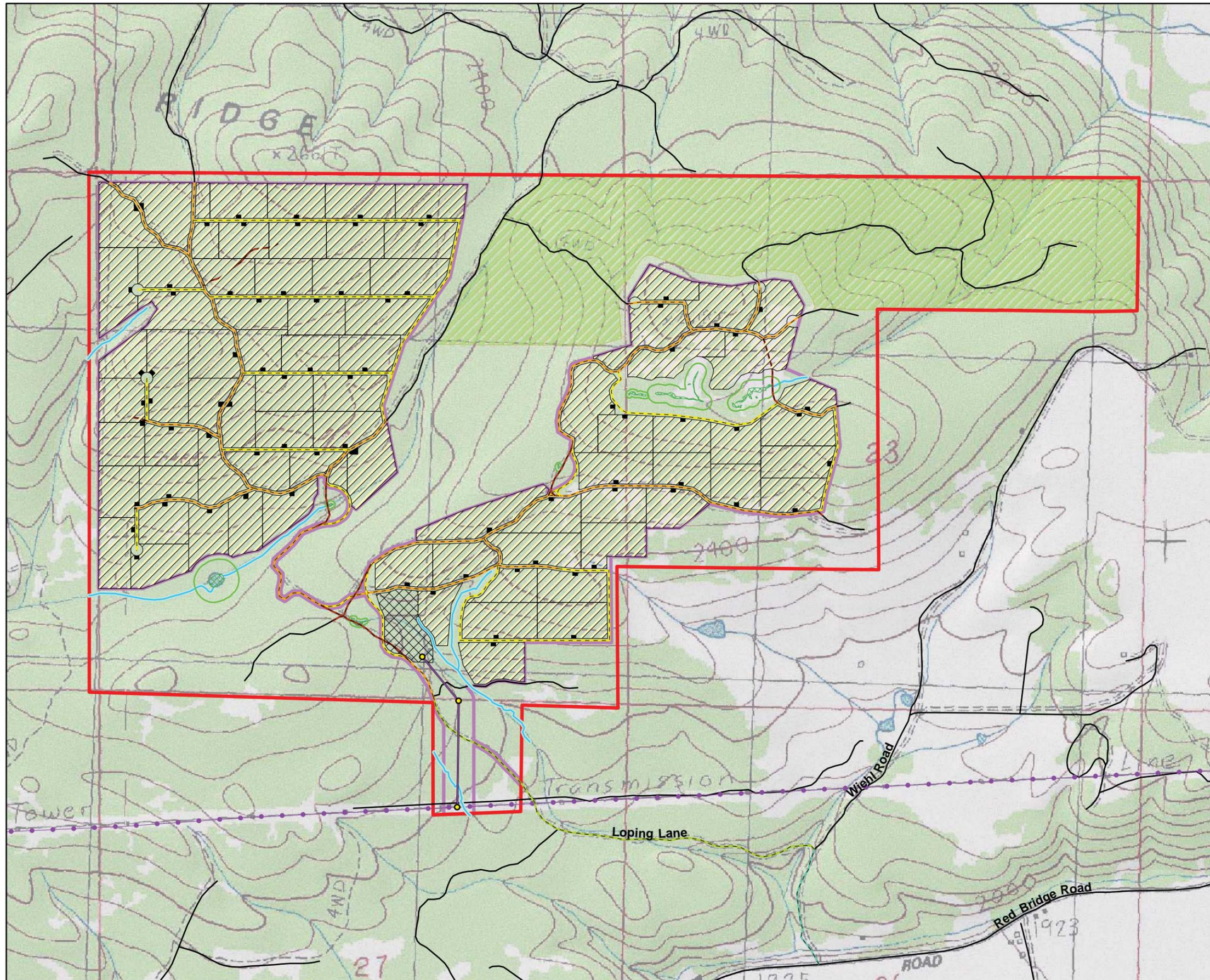
-  Proposed Project Area
 -  City
 -  Highway
 -  River or Stream
- Colockum Herd Area
-  15% Use (614,450 acres)
 -  85% Use (759,195 acres)
 -  Managed to Minimize Elk (510,225 acres)



FIGURE 2
Colockum Herd Map

Wildlife Mitigation Plan
Teanaway Solar Reserve
Kittitas County, Washington





- LEGEND**
- On-site Mitigation Area (193 Acres)
 - Proposed Project Features**
 - Proposed Project Site (477 acres)
 - Proposed Project Area (982 Acres)
 - Proposed PV Array Block
 - Proposed Field Inverter and Field Transformer
 - Proposed Substation/O&M Facility
 - Proposed Transmission Line
 - Proposed Transmission Structure
 - Proposed Maintenance Road
 - Proposed Improved Maintenance Road
 - Existing Maintenance Road (Planned Decommissioning)
 - Proposed Improved County Access Road
 - Proposed Improved Private Access Road
 - Existing Features**
 - Existing BPA Transmission Line and ROW
 - Existing Road
 - Stream
 - Stream Buffer
 - Wetland
 - Wetland Buffer

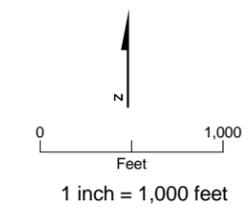


FIGURE 3
On-site Mitigation Area
 Wildlife Mitigation Plan
 Teanaway Solar Reserve
 Kittitas County, Washington

APPENDIX B

**Washington State Department of Fish
and Wildlife Correspondence**



State of Washington
Department of Fish and Wildlife

1701 South 24th Avenue • Yakima, Washington 98902-5720 • (509) 575-2740 FAX (509) 575-2474

September 28, 2009

Ms. Anna Nelson
Kittitas County
Community Development Services
411 N. Ruby St. Suite 2
Ellensburg, WA 98926

RE: Supplemental Explanation of Attachment to Teanaway Solar Reserve comments submitted on September 16th (CU -09-00005).

Concern has been expressed regarding what is depicted in the map titled “*Cougar locations in vicinity of proposed solar reserve*”, which was attached to and submitted with our comment letter. The data is from “Project CAT”, a research project, involving Washington Department of Fish and Wildlife (WDFW) scientists, a carnivore research institute, and the Cle Elum School District. There were 2116 total cougar locations (shown as red dots) identified from GPS collars in the map. The collars were set to provide location signals at four to six hour intervals. The data has not been analyzed or interpreted yet.

The map included 1693 locations from two females between 2003 and 2008 (Cougar #1, 2003-2007 and Cougar #2, 2005 -2008). Of these, 72 percent of the locations occurred between November and April (winter), and 28 percent of the locations occurred from May through October (summer).

The map also included 423 locations from five male cougars between 2002 and 2008. However, only two of the five males were major contributors to the location data points as the others were on the periphery of the map. Of the male cougar locations, 76 percent occurred between November and April (winter) and 24 percent of the locations occurred between May and October (summer).

Thank you for the opportunity to provide these comments. If you have any questions regarding these comments, please feel free to contact me at (509) 457-9314.

Sincerely,

Perry Harvester
Region 3, Habitat Program Manager

APPENDIX C

Landowner Correspondence

September 17, 2009

Ms. Anna Nelson
Kittitas County Community Development Services
411 N. Ruby, Suite 2
Ellensburg, WA 98926

RECEIVED

SEP 18 2009

Kittitas County
CDS

3-20-09

Re: Application of Teanaway Solar Reserve LLC
For Conditional Use Permit (CUP)
Teanaway Solar Reserve (CU-09-00005)

Statement of Position: The Application to site a massive photovoltaic solar generating project, including 400,000 solar panels on 1.5 square miles of beautiful and productive forest land which is prime habitat for many birds and animal species, including the large Teanaway elk herd, is inappropriate and should be denied. A 15 day public comment period for this Application is totally inadequate and should be extended to 90 days. In addition, the expanded SEPA checklist filed by the Applicant is inadequate and flawed. The Applicant should be required to conduct a full environmental impact study (EIS) for its proposed project with ample opportunity for public review and comment before any determination on the Conditional Use Permit is made.

Dear Ms. Nelson:

This letter is written in response to the Notice of Application of Teanaway Solar Reserve LLC for a CUP to build a major industrial solar reserve power plant on 982 acres of land, which is located on land zoned Forest and Range. Pine Hills Ranch is the owner of 500 acres immediately adjacent to the east boundary of the proposed solar site. While we recognize the importance of solar and other alternative energy technologies for meeting our future energy needs, we believe the site chosen is inappropriate and incompatible with the historical character of the whole area, with the current uses of the site, with the important wildlife habitat that the site and surrounding area provide and with the current uses of the surrounding property ownerships.

The project area as described by the Applicant consists of 982 acres, or about 1.5 square miles. The surface of the panels alone would cover about 160 acres (400,000 panel x 17.1 square feet per panel / 43560 square feet per acre) without even considering the added panel structures, posts, concrete footings, substations, access roads and other infrastructure related to the project, which will be sited on south sloping (in some cases steep) terrain. This industrial project will have a devastating impact upon the wildlife and mixed Ponderosa forest and meadows on the site and cause severe impacts on its surrounding neighbors and the general area, including potentially the Teanaway River.

In light of these impacts, it is totally inappropriate to allow only 15 days for comment on the CUP Application and expanded SEPA checklist for this project, which will be huge in scope and, according to the Applicant, will be the largest of its kind in the United States and possibly

world. The current comment period should be enlarged to 90 days to give the public reasonable opportunity to comment. It is also inappropriate for the County to apparently prejudge the SEPA review by stating in the Notice that "the County expects to issue a Determination of Non-Significance (DNS)" when the Application with its hundreds of pages of documentation was just received on August 18, 2009, and other parties have not even had a chance to comment, let alone read it. This statement is particularly egregious because the Applicants filing contains many "conceptual" representations, which make analysis of the impacts of where and how the proposed improvements will actually be constructed difficult, if not impossible, for both the County and impacted property owners to evaluate. Many of the SEPA responses provided by Applicant are either incomplete or inaccurate, and the Applicant has made no attempt to verify their data.. The construction of a huge industrial energy production facility in the middle of a beautiful and productive forest and meadow ecosystem which hosts a large wildlife population is not appropriate. This type of project requires the undertaking of a full environmental impact review (EIS) for the project.

Given the short time period for responses and the unclear dividing line between issues relating to the Conditional Use Permit, the Development Agreement, and the SEPA review, our comments will be general and will apply to all of these documents. Pine Hills Ranch, specifically and without limitation, reserves the ability to raise new issues as they arise. Further, Pine Hills Ranch, specifically and without limitation, reserves and does not waive its ability to appeal all aspects of this project, including the County's procedural and substantive SEPA decisions, the Board of Adjustments approval of the project and the County's entry into the Development Agreement.

A. Pine Hills Ranch. Pine Hills Ranch LLC consists of 3 cabins located on about 500 acres of forest and meadow, extending from Weihl Road on the south to the Teanaway River on the north. Our road access is from Weihl Road.. We abut the solar reserve as proposed on its east and northeast borders. Our property, which has been used for forestry, open space, agriculture and recreation is owned by 11 families. The property was acquired in the late 1960s, so we have a long term familiarity with the proposed solar site, as well as our own property. In the early years, cattle were grazed on our property and the solar site (Boise Cascade property then) by a local rancher. Over the years we have hiked, skied, and biked on the proposed site. We have also held or hosted a number of orienteering meets using the site in conjunction with our own property. In fact, the Cascade Orienteering Club created a very detailed and expensive map (with several recent updates) of the whole area for a national meet held there and for many subsequent meets, all done with the permission of the land owner. In excess of 2000 participants have crossed the site during these events. A copy of the revised 1994 orienteering map with Applicant's Figure 5 Conceptual Site Layout placed on it is provided as Attachment A. (Please note that an arrow indicates True North, while the map's vertical lines are oriented to magnetic north for orienteering purposes). Over the years, Boise Cascade did some of the logging on our property, and on several occasions we allowed them to move their logs across our property. We love the land and try to manage it in an environmentally sound manner. We do not allow hunting on our property, and it therefore is somewhat of a sanctuary for the abundant wildlife that lives on and crosses our property, much of it coming from or going to or through the proposed solar site.

B. Proposed Solar Site. Contrary to the discussion in some of the Applicant's supporting materials, the proposed site is a special property with an open pine forest with lovely wetlands and meadows. In the spring, the land is green and full of flowers. As discussed in a later section, birds and animals can be found throughout the area. This land has always been used as commercial forest with some cattle grazing. In recent years, the pine forest has been badly overcut in our opinion, and particularly on the south, dry slopes it has suffered. Trees grow slowly at this elevation, but the property is beginning to heal, with many new seedlings coming up. Aerial photographs of the site provided by the Applicant give the appearance of very few trees, but there is much more cover when viewed from ground level. As noted previously, the site has been overcut, but there are still many trees of various ages, and it remains an open Teanaway ponderosa forest. Looking at aerial photographs in the Applicant's filing, our property line is obvious because of the denser forest cover on our side. See Attachment B (Applicant's Figure 5, Conceptual Site Layout). Forestry requires a long term horizon in the Teanaway area. As detailed in the next section, in addition to its uses as a commercial forest, the property has been and is continuously used for recreation by neighbors and many in the Cle Elum community.

C. Recreational Uses. As opposed to the discussion in Applicant's Application (see SEPA Checklist p.36), the site area has been used by neighbors and people from the Cle Elum community for recreation in ways that don't interfere with forestry operations for as long as we have been neighbors, and probably long before. The site is often hiked, biked and visited by bird and flower enthusiasts. Many ride horses through it, including Flying Horseshoe Ranch down in the valley and other horse groups. Hunters frequent the site during hunting season, looking for deer, elk and bear, which has on occasion caused us problems when they stray on to our property where we do not allow hunting. As previously discussed, many orienteering meets have been held on the property. Thus, if the Applicant actually enforces a prohibition on public access to the site, there will be a significant loss of public access and recreational opportunities.

D. Plant Life. We are not in a position in this short comment period to comment on endangered plants on the site (unlike the Applicant, we have not had unlimited time to prepare materials for this proceeding). However, as noted by Applicant, there are a number of meadows and wetlands on the site. Some of these areas dry up with the heat of late summer and some stay wet. In many areas the plant life stays green and the soil damp long after the surface water is gone. They again recharge with the fall rains. These areas are frequented by wildlife. If these areas are surrounded by arrays of solar panels, roads and other solar infrastructure, they will be substantially impacted either by the flash run-off of water from solid surfaces or by the diversion of water resulting from these structures. (See also G. Hydrology). It is also doubtful that these sites will continue to attract the deer and elk, and this issue should be studied as part of an EIS.

E. Animals. The area of the proposed solar site has sizable populations of birds, reptiles and mammals. The site is generally similar to our property in terms of the wildlife on the site. Wildlife are not concerned with property lines, unless there is fencing, and there currently is no fencing. During the day, one regularly sees red-tail hawks soaring over the site looking for mice or other small animals, and at night it is the sound of owls hooting. All sorts of birds, raptors including hawks, owls and occasional eagles, quail, wild turkey, deer, elk, coyotes, cougar and bear frequent the site. We do not know if there are spotted owls or other endangered birds on the

site, but Applicant's brief and superficial survey does not adequately address this possibility.

Applicant's wildlife field studies also failed to establish wildlife baselines for the different seasons of the year, even though the variety and numbers of a given species can change dramatically by season. For example, that is a major reason why in Applicant's SEPA checklist, its consultants found few deer and elk on the site. They conducted animal field studies on June 16-19 and July 9, 2009, which is the beginning of the hot summer months, particularly on the site's south facing slopes. While the many small mammals may stay put during the day and wait for cooler evenings, the larger mammals such as deer and elk that do stay around simply move back and forth to avoid the heat of the day. They will then move through Applicant's site, as they do on our property, in the evening or in the early morning and then move to the cooler, more heavily forested areas on the north facing slopes or down to the Teanaway River during the heat of the day. Consequently, it is not surprising to see few deer or elk, let alone predators, during the day during hot summer months.

Of course, some of the deer and many of the elk do migrate to the higher country during the summer months, but they are on the proposed solar site and our property more months than they are gone. We typically see the larger herds move back in early October, and many remain into June, with some stragglers staying through most of the summer. Animal field studies done in late June and July will therefore miss, as they did in this case, the big herds that are resident for much of the year.

Applicant's characterization that the elk winter down by the Teanaway River is also only partially true, and it depends a great deal on the snow cover. With increasing development in the valley and along the Teanaway River, they appear to have moved more into the uplands, which include the solar site. The south facing slopes of the solar site often lose their snow cover early which provides easier access to food. It is not unusual to count 40-50 elk in our field, and on one occasion I lost count at 130 elk. The elk don't care about property lines, and they move daily across our property and the solar site, as well as other properties. The tracks from the herd leading in to the solar site are easy to spot in the snow.

The solar site also provides habitat for predatory animals such as coyotes, cougar and bear, which frequent the proposed site along with our property. I have observed a coyote den on the site within the proposed eastern setback area near our property line. We have also observed cougar tracks and bear scat on the site. Cougar have large territories and tend to follow the movements of the deer and elk herds. We have seen them on our property, and I have confirmed their presence on our and the adjacent site through the tracking program of Project CAT. We found 5 winter kills of deer or baby elk on our property alone this spring.

The bottom line of this discussion is that deer and elk and their associated predators are far more prevalent on the solar site for much more of the year than indicated by Applicant's field studies. And the species and number of birds will also vary with the season. For example, we see and hear more owls in the late fall and winter when the Great Horned Owls move south. If the Applicant's animal study had been done at various intervals throughout the year, there would have been significantly more large mammals observed. We believe that Applicant's study conducted over a five day period in one year is wholly inadequate to truly gauge the impact of this huge project on animals in the area .

F. Fencing/Access. The issue of fencing is a very important issue in the discussion of the effects of the project on wildlife. As we have already discussed, there are large populations of deer and

elk, as well as the predators that follow them, that move on a daily basis on and across the site. Some of these animals also seasonally migrate in the late spring to the higher country and return in early fall. The 982 acre project site extends from the populated south side located around the upper end of Weihl Road up across Cle Elum ridge and down to the Teanaway River, or about a mile. The site extends east-west almost 2 miles at its widest point. If the site was fenced, the wildlife on and around the site would be decimated.

On the other hand, Applicant states that there will not be public access to the site and that the gate will be locked. Without fences, how will the Applicant keep out the same public that has traditionally used the site in the past, when they state that the same 'no public access' policy was in effect?. A major difference, of course, is that in the past there were only trees on the site. The proposed project will place millions of dollars of solar panels, wiring, buildings, transmission lines and other equipment on the site. How will this be protected from vandalism, theft, target shooting? Will Applicant seek to change this policy in the future?

This issue cannot be addressed in a 'conceptual' manner. If Applicant agrees that no fences will ever be built on the site, this must be explicitly stated as an enforceable condition of the permit.

Even in the absence of fencing, Applicant has provided no evidence that deer and elk will spend much time walking or grazing under huge arrays of solar panels and between thousands of supporting structures, with maintenance and security vehicles in the area. Fire protection will require cleared areas around and under the equipment. Thus wildlife, both birds and mammals will effectively be displaced from 500+ acres of the site. The impacts of this displacement must be evaluated as part of an EIS, which addresses the issues of wildlife corridors, buffers and open areas in designing the project. We have been informed by WFW that the elk herd is currently below target levels and that there is a shortage of habitat. Applicant's project would further reduce that habitat.

In an attempt to be more specific about elk movements, regardless of the season, I have marked on attachment B (Applicant's Figure 5 Conceptual Site Layout0) our general observations of the main elk movements, both daily and seasonally, which cross our property on to the east/northeast corner of the solar site. Although they cross at virtually all points, in a general sense they move up Cle Elum ridge to the upper meadows and also onto the north facing slopes above the Teanaway River. The deer cross on to the site in more random fashion.

As attachment B shows, Applicant's "conceptual" design shows about a 500 foot setback along its eastern boundary and very little development proposed in the northeast part of their site. This fact is probably due primarily to the north facing nature of the land as it slopes down toward the Teanaway River in much of this area. Regardless of the reason, if the CUP is approved, this setback along its boundary and the northeast part of the site should be left in its natural state and set aside as wildlife corridor and wildlife open space to protect the elk, deer and predator populations. We are not very familiar with the western portions of Applicant's site and therefore do not comment on it specifically, other than to note that it is all part of the same ecosystem, and it also should be studied as part of an overall EIS.

G. Forestry. As discussed previously, the solar site has been used over the years primarily to grow timber, and the site has been logged many times. The site currently suffers the result of over-aggressive logging, but it remains valuable for forestry as well as habitat, as long as one takes a long term view of forestry. It is our understanding that the land owner wanted to cut more aggressively on the south facing slopes of the site, but was not allowed to do so. Consequently,

there remain quite a few trees serving both as seed trees and animal habitat. The solar project would presumably remove most of the remaining trees on these slopes to make way for solar panel arrays, roads and other solar infrastructure, thus eliminating valuable animal habitat, eliminating views and buffers, and creating substantial water run-off issues, which have not been addressed by Applicant.

The "artist's conception" pictures of the site distributed by Applicant as part of its public relations program show a lovely pine forest with intermingled solar panels. This is not the real life view of what this industrial site would look like after construction.

H. Hydrology. Applicant's depiction of the developed portion of its site places the majority of its panel arrays on the south facing slopes, which makes sense for photovoltaic power generation. In fact, some of these south facing slopes are quite steep. However, Applicant hardly mentions the water run-off and siltation issues that will result from the construction and maintenance of this solar facility. This run-off and silt will ultimately end up in the Teanaway River, a river that has species of fish, including Bull Trout, that are listed as threatened and/or endangered under the Endangered Species Act. Both the Teanaway and Yakima Rivers are also currently the focus of state and federal efforts to restore salmon runs.

Picture a heavy rain or snowfall, or even a combination of the two, falling on these slopes denuded of most of their trees and covered with about 160 acres of solar panels plus many additional acres of impervious surfaces for roads and other structures. The water will sheet off of the site on to properties downhill and ultimately to Red Bridge Road, the valley and the Teanaway River.

If this scenario sounds familiar, it is exactly what happened last January when the large Chinook or Pineapple Express hit the upper County, causing extensive damage to Red Bridge Road, Weihl Road, and surrounding properties and access roads, including our road. The whole hillside was a river of water and snow flowing toward the Teanaway and Yakima Rivers. And this occurred before any solar project was built! Although last January's 'event' was extreme, we have seen a number of January/February Chinooks over the years, and global warming projections indicate that there will be more of them.

The flash run-off effect of the project may also negatively impact ground water recharge. Water running rapidly off of this huge site, which has been denuded of tree cover, will not percolate slowly into the ground water, where it slowly will work its way to the valley and the Teanaway River, feeding wells along the way. This issue is already a major issue of contention between the County and the Department of Ecology, with the resulting ban on new wells.

Finally, we also have serious concerns with pollutants from the metal, alloys, plastics, lubricants, glues, etc. which may wash off of the solar structures from this huge scale project into surface water, into the wetland areas, and potentially into ground water. We have the same concern with the herbicides used to control brush and grass around and under the panels that will wash off the site.

Applicant has failed to address these issues in any meaningful way and they need to be addressed in an EIS.

I. Access. The proposed road access to the solar site comes up the lower portion of Wiehl Road and then branches west on to Loping Lane past a number of homes and undeveloped properties before reaching Applicant's gate. Weihl Road continues beyond Loping Lane for a substantial distance and provides access to a large number of homes, plus a number of subdivided lots which

have not yet been developed. Weihl Road is a public right-of-way, but it is not currently maintained by the County. It is a gravel road maintained intermittently by various land owners, but it has been in very poor condition since the January storm. We do not know the ownership of Loping Lane. Applicant paints a picture of very few homes and very little traffic on Weihl Road, which is not correct.

The proposed development of the solar site would have a very damaging impact on both Weihl Road and Loping Lane. The transit of large numbers of trucks and other heavy equipment making thousands of vehicle trips on these gravel roads over a number of years of construction and then ensuing maintenance of the facility will tear them up in the long mud and ice season and will turn them to dust storms in the dry season.

If the County decides to approve the solar project, it must require the developer to improve Weihl Road to paved County standards and the County should then accept the road and maintain it. Logic would suggest that the same should be done for Loping Lane, but we will let those owners address that issue. It should also require that Applicant provide a secondary access to its site as it requires in other developments.

J. Proposed Setbacks. Applicant has only provided a “conceptual” view of the actual solar panel placement on its site and the related project setbacks from its property lines. This conceptual representation is included as Attachment B. This attachment shows about a 500 foot setback along our joint property line. Because this is only a conceptual representation, we have no way to determine if this setback is adequate to mitigate the impacts to our property.

We believe that a larger setback will not only help to shield our property from some of the negative effects of the project but also help to provide a buffer and corridor for deer, elk and other wildlife to move up the slope to the north facing areas of the site, where Applicant shows no construction and where we have observed the most deer and elk activity. These setbacks should be made a condition of any permit and not something to be applied in Applicant’s discretion.

Applicant also shows only a minimum setback of 100 feet along portions of its southern boundary which pass close to a number of substantial homes. Although we assume that this issue will be addressed by those neighbors, this minimum setback seems unreasonable in light of its direct visual impact.

K. Noise. Applicant is silent on issues about noise resulting from the project. Obviously, if the project is approved, there will be considerable machinery noise from excavators, cement trucks, dump trucks and other equipment working on, in some cases, steep hillsides during the years of the construction phase. This issues needs to be addressed.

However, nothing has been said about the noise that might be generated by 15,000 solar panel arrays moving to track the sun, resetting at the end of the day, and potentially turning in unison to dump snow load in the winter. And do 400,000 solar panels producing power on a sunny day produce a sound?

In addition, anyone familiar with the upper County is aware of the strong winds that regularly blow through the area and along the hillsides of the proposed site. Just the afternoon wind is almost a daily occurrence. What noise does the wind make when it blows through 400,000 solar panels and 15,000 solar panel arrays? Does it whistle, shriek or just sound like the wind? We don’t know the answer, and Applicant hasn’t addressed it, but it could have a very serious impact on neighbors, surrounding land values and wildlife.

Applicant has bragged about the size of this project as being the biggest in the United States

and maybe the world, yet it has said nothing about the noise which may be generated by the size of its project. The noise issues are required to be addressed now under our understanding of the SEPA process. Applicant should be directed to address these noise issues as part of a full Environmental Impact Study.

L. View. Applicant downplays the visual impact of its constructed solar facility in its Application. This is definitely not the case for neighbors along the south line of the project who will be looking directly at a hillside lined with solar arrays with minimal setbacks or screening. As best as we can ascertain, the visual impact of the project should not be a major issue for us, once we are on our property, provided that adequate setbacks are imposed. However, it will be very apparent to us or anyone driving on the upper portion of Weihl Road. Attachment C is a panorama picture taken from our gate on Weihl Road looking up the ridge in a northwest direction. It shows several of the homes along the south border of the project, and more are out of sight up the hill to the west. It appears that most of the trees on and close to the ridge line in the right center portion of the picture will be removed and replaced with solar panel arrays.

In addition, since we can see our property from several high points along I-90 going to or from Ellensburg, the site will be visible from a large distance once the trees adjacent to us are replaced with massive arrays of solar panels. The site will also be visible to many properties that have an elevated view of Cle Elum Ridge, which covers a considerable territory. These issues should also be evaluated in the context of a full EIS.

M. Fire Danger. Fire is a concern to all who live in or near the woods and grasslands in the Teanaway area, particularly with its summer hot, dry and windy conditions. Applicant will have a huge number of wires, electrical connections, transformers, electric substations, a transmission intertie and other electrical equipment in close proximity with acres of dry grass under its approximately 160 acres of solar panels. What facilities such as water storage, pumping facilities and fire response equipment will Applicant have on site to respond to any fires that may start on its site, so that they do not quickly spread to adjacent properties before the fire district can respond? Applicant should be required to respond to this concern as part of a full environmental impact study.

Conclusion: Applicant promotes this huge solar project as a 'green' project. We submit that it is not a 'green' project, since it displaces a productive, carbon-fixing forest and meadow ecosystem containing important and healthy wildlife habitat, including large herds of deer and elk. If this project were located in the open, arid lands by Vantage or further east or on the Hanford Reservation, it would be 'green'. Since Applicant has chosen to place its project on this inappropriate site, its proposed project and the many damaging impacts that it would create must be fully examined with a thorough environmental impact statement.

Respectfully submitted



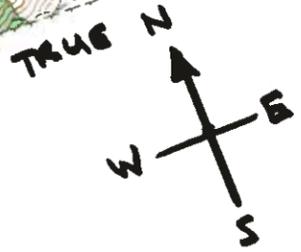
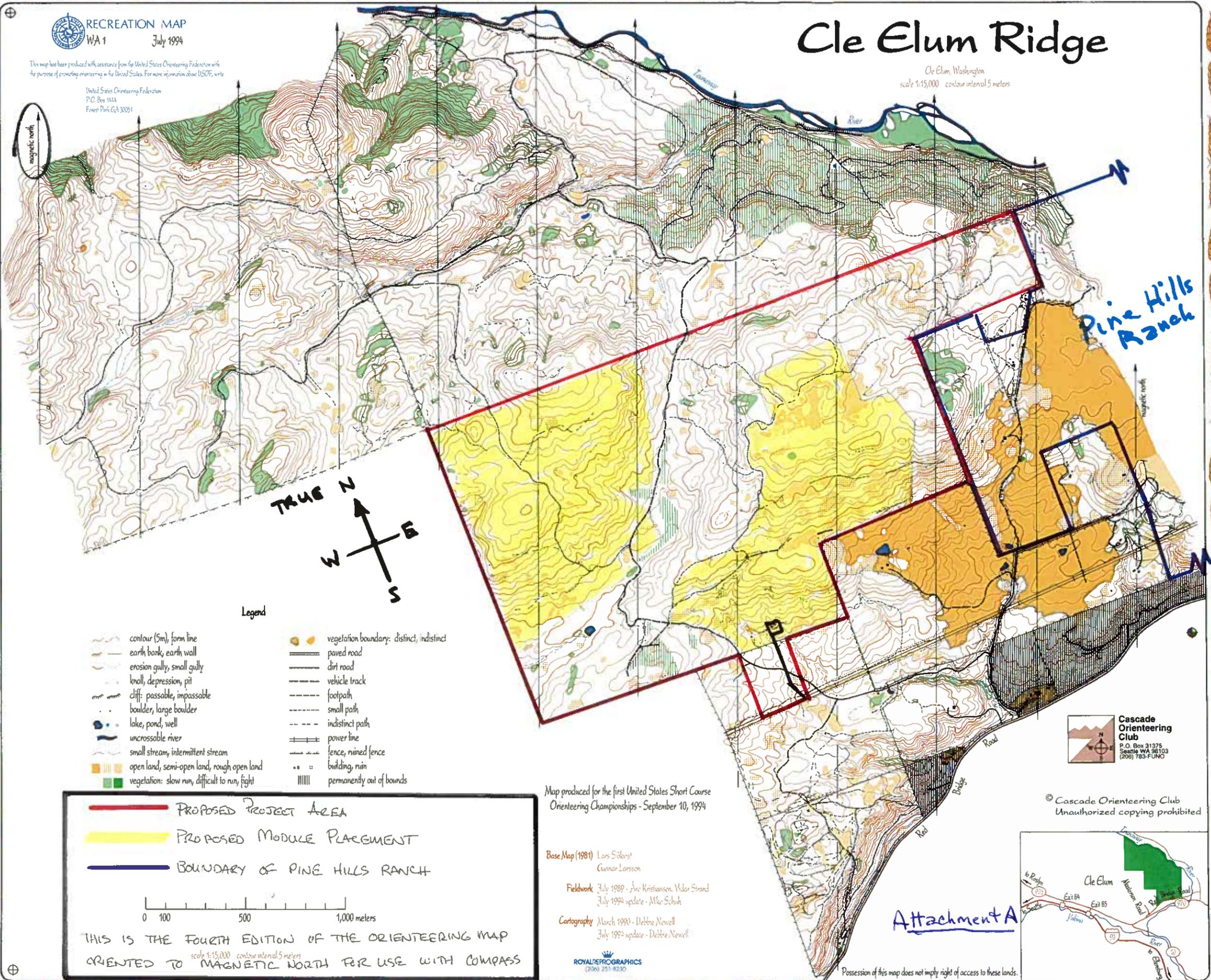
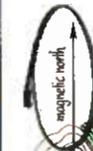
Charles Adams
General Manager
Pine Hills Ranch LLC

This map has been produced with assistance from the United States Orienteering Federation with the purpose of promoting orienteering in the United States. For more information about USOF, write:

United States Orienteering Federation
P.O. Box 1644
Forest Park GA 30051

Cle Elum Ridge

Cle Elum, Washington
scale 1:15,000 contour interval 5 meters



Legend

- | | |
|---|---|
| contour (5m), form line | vegetation boundary: distinct, indistinct |
| earth bank, earth wall | paved road |
| erosion gully, small gully | dirt road |
| knoll, depression, pit | vehicle track |
| cliff: passable, impassable | footpath |
| boulder, large boulder | small path |
| lake, pond, well | indistinct path |
| uncrossable river | power line |
| small stream, intermittent stream | fence, ruined fence |
| open land, semi-open land, rough open land | building, ruin |
| vegetation: slow run, difficult to run, fight | permanently out of bounds |

PROPOSED PROJECT AREA

PROPOSED MODULE PLACEMENT

BOUNDARY OF PINE HILLS RANCH

0 100 500 1,000 meters

THIS IS THE FOURTH EDITION OF THE ORIENTEERING MAP
scale 1:15,000 contour interval 5 meters
ORIENTED TO MAGNETIC NORTH FOR USE WITH COMPASS

Map produced for the first United States Short Course Orienteering Championships - September 10, 1994

Base Map (1981) Lars Silovst
Cunnar Larsson

Fieldwork July 1989 - Åke Kristiansen, Vidar Strand
July 1994 update - Mike Schuh

Cartography March 1990 - Debbie Newell
July 1992 update - Debbie Newell



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Attachment A

Possession of this map does not imply right of access to these lands.

Large Panarama Picture from Pine
Hills Ranch gate looking at hillside
of solar site.

Not attached.

Attachment C

APPENDIX D

Washington State Elk Herd Plan
Colockum Elk Herd

Washington State Elk Herd Plan

COLOCKUM ELK HERD

**Washington Department of Fish and Wildlife
Wildlife Program
600 Capitol Way North
Olympia, WA 98501-1091**

Prepared by

Jeff Bernatowicz, District Wildlife Biologist

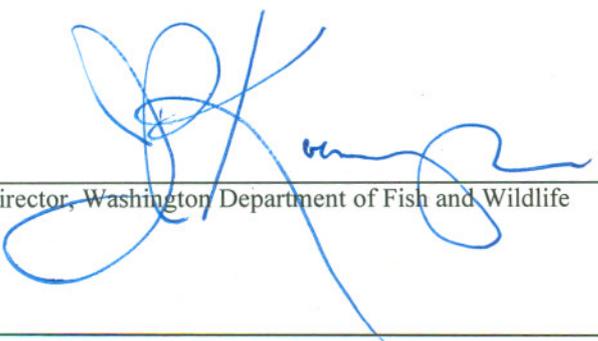
October 2006

Washington State Elk Herd Plan

COLOCKUM ELK HERD

Washington Department of Fish and Wildlife
Wildlife Program
600 Capitol Way North
Olympia, WA 98501-1091

OCTOBER 2006



Director, Washington Department of Fish and Wildlife

3/06/07
Date

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COLOCKUM ELK HERD PLAN

EXECUTIVE SUMMARY

The Colockum Elk Herd is the fifth largest of ten herds identified in the State. It is an important resource that provides significant recreational, aesthetic, cultural, and economic benefits to recreationists, local communities, and Native Americans. The purpose of this plan is to provide direction for the management of the Colockum elk resource for the next 5 years. The plan is subject to amendment. Priority management activities will be implemented as funding and resources become available.

There are three primary goals for the Colockum Elk Herd: (1) To preserve, protect, perpetuate, and manage elk and their habitats to ensure healthy, productive populations; (2) to manage elk for a variety of recreational, educational and aesthetic purposes including hunting, scientific study, cultural and ceremonial uses by Native Americans, wildlife viewing, and photography; and (3) to manage the elk herd for a sustainable yield.

Specific elk herd and habitat management goals, objectives, and strategies have been identified in the plan. These are priority objectives identified to address specific problems in elk management. To accomplish each objective a variety of strategies have been developed. The following objectives have been identified:

- Maintain the population objective at 4,500 animals +/- 5% in the surveyed portion of the winter range. Assess the long-term social tolerances and habitat limitations for the Colockum elk herd and if necessary, adjust the population objective accordingly.
- Maintain the post-season elk population composition ratios in the surveyed area of the Colockum Herd within the objectives of the Game Management Plan, currently at 12-20 bulls: 100 cows, with 2-10% of bull sub-population made up of mature animals, and total bull mortality of less than 50%.
- Improve elk habitat quality and minimize disturbance to the elk herd during critical times of the year.
- Minimize complaints and damage caused by elk, thereby improving landowner support for Colockum elk management.
- Work cooperatively with the Yakama Nation to collect and share data pertaining to the Colockum herd.
- Increase public awareness of the Colockum herd and develop elk viewing opportunities.
- Work with public land managers to improve and protect elk habitat on state and federal lands including WDFW, DNR, and USFS. Work with private land managers to improve and protect elk habitat on private lands.
- Conduct research where needed to provide essential data for improving management of Colockum Elk.

Spending priorities have been identified for the first year and the next 5 years. Achieving spending levels will be contingent upon availability of funds and creation of partnerships. The recommended annual priority expenditures for the Colockum herd are as follows:

<u>Priority</u>	<u>1st year cost</u>	<u>5 year cost</u>
Herd population/composition surveys	\$14,000	\$70,000
Reduce burden of elk on private landowners	\$112,000	\$480,000
Work with landowners and livestock operators to enhance elk forage	\$25,000	\$75,000
Access Management	\$65,000	\$215,000
Habitat Management	\$30,000	\$90,000
Purchase critical elk habitat	\$1,000,000	\$5,000,000
Research	\$75,000	\$350,000
TOTAL	\$1,321,000	\$6,280,000

INTRODUCTION

The Colockum Elk Herd Plan is a step-down planning document under the umbrella of the Final Environmental Impact Statement for the Game Management Plan (WDFW 2002). For management and administrative purposes, the State has been divided into Game Management Units (GMUs). Logical groups of GMUs are described as a Population Management Units (PMU). The Colockum elk herd is one of ten herds designated in Washington. In this context a herd means a population within a recognized boundary as described by a combination of PMUs. The Colockum Elk Herd is in south portion of PMU 26 (GMUs 249 and 251) and PMU 32 (GMUs 328, 329, 330, 334 north of Interstate 90, 335). The core population resides in PMU 32 and most elk in this area exhibit a typical seasonal migration from high elevation summer ranges to lower elevation wintering grounds.

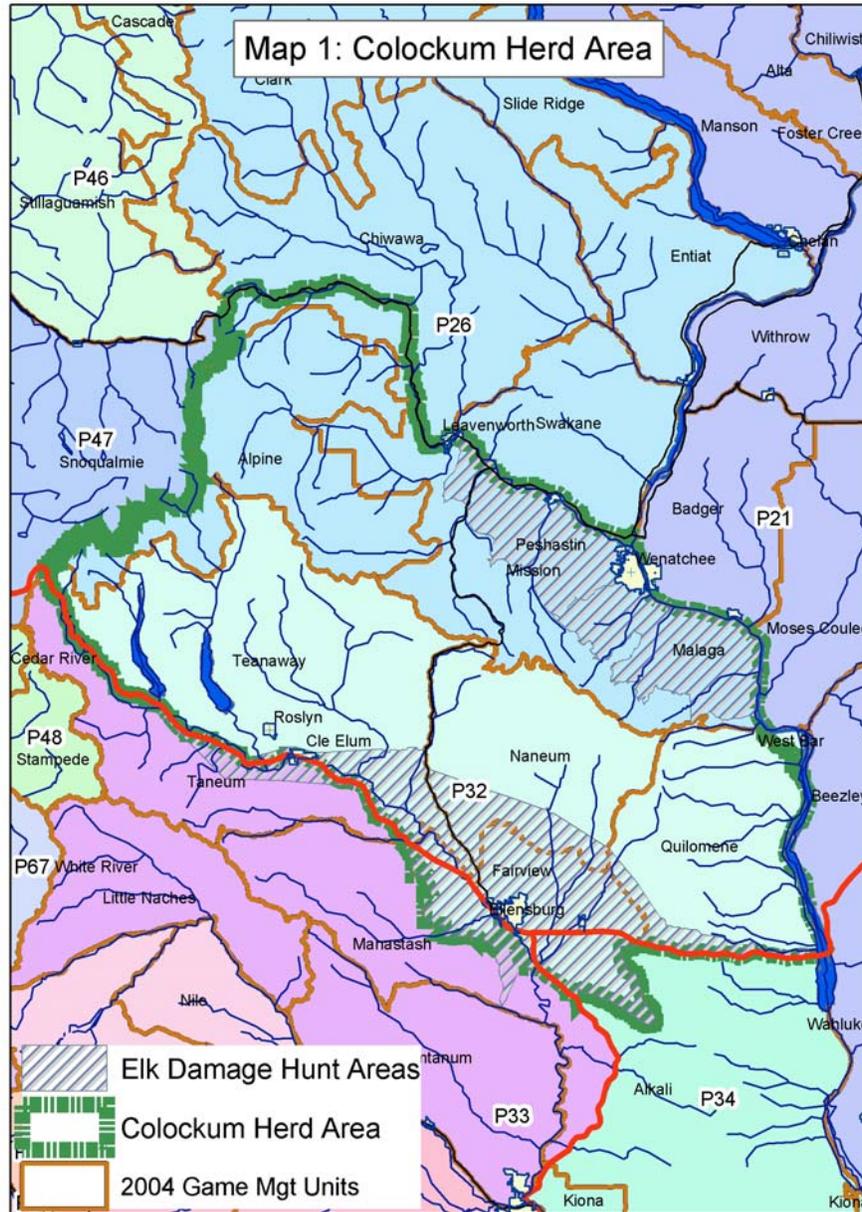
The Colockum Elk Herd Plan is a five-year planning document subject to annual review and amendment. The Washington Department of Fish and Wildlife recognizes the sovereign status of federally recognized treaty tribes. This document recognizes the responsibility of the Washington Department of Fish and Wildlife and Yakama Nation to work cooperatively in achieving elk management goals and objectives. It also recognizes the role of private landowners and public land management agencies in providing habitat for elk, notably the U.S. Forest Service, Bureau of Land Management, Washington Department of Fish and Wildlife, and Washington Department of Natural Resources.

HERD AREA DESCRIPTION

Location

The Colockum elk herd ranges over 1,600 mi² between the Columbia River to the east and the Cascade crest to the west and U.S. Highway 2 to the north and Interstate 90 to the south. Areas north of Highway 2 are within the herd range, but are managed to minimize elk. Approximately 85 percent of the elk use occurs on the eastern half of this area; east of the Teanaway River and Peshastin Creek (Map 1). The western half has about 15 percent of the elk use (Bracken and Musser 1993). The Game Management Units (GMUs) that comprise the Colockum elk herd area include 249 (Alpine), 251 (Mission), 328 (Naneum), 329 (Quilomene), 330 (West Bar), 334 (Ellensburg) north of Interstate 90, and 335 (Teanaway).

Map 1: Colockum Elk Herd Area



Land Ownership

Land within the Colockum herd's range is of mixed ownership and includes lands owned by Washington Department of Fish and Wildlife, U.S. Forest Service's Wenatchee National Forest, Washington Department of Natural Resources, U.S. Timberlands, Plum Creek Corporation, Longview Fiber Corporation, and many private landowners. Timber, livestock, mining, oil and gas exploration, irrigation, hydroelectric power, winter sports, and a variety of outdoor recreation pursuits are all industries and activities important to the economy of the area. During spring, summer, and fall when elk are widely distributed, the U.S. Forest Service manages the greatest percentage of the elk habitat. The Washington Department of Fish and Wildlife manages the greatest proportion of the Colockum elk herd winter range. Depending on the season, individual private landowners collectively control about one-quarter of the core elk habitat identified by Bracken and Musser (1993) (Table 1). Bracken and Musser did not evaluate land ownership in GMU's 249 (all USFS wilderness), the west portion of 251, or the western majority of 335.

Table 1: Percentage of area managed by ownership and season for the Colockum elk herd

(Bracken and Musser 1993).

Season	WNF/BLM ^{a,b}	WDFW ^a	DNR/PARKS ^{a,b}	Corporate	Private
Spring	28	23	9	19	21
Summer	38	16	8	21	18
Fall	21	30	22	8	19
Winter	2	49	11	14	25

^aWNF = Wenatchee National Forest, BLM = Bureau of Land Management, WDFW = Washington Department of Fish and Wildlife, DNR = Washington Department of Natural Resources, Parks = Washington State Parks.

^bThe BLM and PARKS manage relatively little land used by Colockum elk. In winter, State Parks manages 2% of the elk winter range. In other seasons, these ownerships total less than 1%.

Topography

The Colockum herd area varies in elevation from 584 feet on the Columbia River to over 9,000 feet in the Alpine Lakes Wilderness. Physiographically, the area is part of the Northern Washington Cascades and the Columbia Basin Provinces as described in Franklin and Dyrness (1973).

Climate

During the summer, afternoon temperatures in the lower valleys occasionally reach over 100°F. In winter, average maximum temperatures are from 30° F to lower 40° F, while minimums range from between 10-20° F. During some of the coldest winters, minimums have dropped to -20° F.

Precipitation is light in summer, increases in the fall, and reaches a peak during the winter. Annual precipitation ranges from less than 10 inches along the Columbia River to over 100 inches in the Cascade Range. Average winter snowfall ranges from 10 to 40 inches in the lower elevations, 30 to 70 inches in the intermediate areas, and 100 inches or more in the Cascade Range. Snow seldom remains on the ground longer than six weeks in the lower elevations (Donaldson 1979).

Vegetation

The east facing slopes of the Cascade Range are a diverse mosaic of forest cover-types. On drier low-elevation sites ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii*) are the most conspicuous over-story species. Canopy cover typically ranges between 20-50 percent on these relatively dry, low-elevation sites. At mid-elevations, grand fir (*Abies grandis*) is the climax species, with Douglas fir, lodgepole pine (*Pinus contorta*), ponderosa pine, and western larch (*Larix occidentalis*) as minor components. At higher elevations, sub-alpine fir (*Abies lasiocarpa*) is the climax tree species. Canopy cover at higher elevations is generally greater than 40 percent. Other tree species commonly found in the sub-alpine fir zone include Engelmann spruce (*Picea engelmannii*), lodgepole pine, and western larch.

The under-story component of the forest cover types varies greatly with precipitation, aspect, elevation, and canopy cover. Under sparse canopy cover, the under-story often resembles shrub steppe communities with antelope bitterbrush (*Purshia tridentata*), ocean spray (*Holodiscus* spp), Oregon grape (*Berberis nervosa*), sagebrush (*Artemisia* spp), snowbrush (*Ceanothus velutinus*), and Spiraea (*Spiraea* spp) in the shrub component. At higher elevations additional shrubs include barberry (*Berberis* spp), currant (*Ribes* spp), huckleberry (*Vaccinium* spp), mountain snowberry (*Symphoricarpos albus*), and mountain boxwood (*Paxistima myrsinites*). Forbs commonly found in under story communities include arrowleaf balsamroot (*Balsamorhiza sagittata*), cinquefoil (*Potentilla* spp), heartleaf arnica (*Arnica cordifolia*), lupine (*Lupinus* spp), milk-vetch (*Astragalus* spp), and western yarrow (*Achillea millefolium*). Pine grass (*Calamagrostis rubescens*) and elk sedge (*Carex geyeri*) are the major forage plants of the grass/sedge component.

The remaining area supports shrub-steppe plant communities characteristic of the Columbia Basin physiographic province (Franklin and Dyrness 1973). Bunchgrass and sagebrush communities are the typical vegetation types on deep gently sloping upland soils (Daubenmire 1970). Common shrubs include antelope bitterbrush, big sagebrush, gray rabbitbrush (*Chrysothamnus* spp), and spiny hopsage (*Gray spinosa*). Perennial bunchgrasses, such as basin wildrye (*Elymus cinereus*), bluebunch wheatgrass (*Agropyron spicatum*), Idaho fescue (*Festuca idahoensis*), and Thurber's needlegrass (*Stipa thurberiana*), are important forage species on relatively undisturbed sites. Alien grasses (e.g., cheat grass *Bromus tectorum*) and Kentucky bluegrass (*Poa pratensis*) and forbs (e.g., knapweeds, *Centaurea* spp) often are dominant on disturbed areas. On shallow soils, low-growing shrubs, such as stiff sagebrush (*Artemisia rigida*) and a variety of buckwheat (*Eriogonum* spp), and Sandberg bluegrass (*Poa secunda*) are the dominant species. Common forbs in the shrub-steppe zone include Carey's balsamroot (*Balsamorhiza careyana*), lupine (*Lupinus* spp), longleaf phlox (*Phlox longifolia*), western yarrow, and Indian paintbrush (*Castilleja* spp).

Human Influences

Humans greatly influence the Colockum elk herd. Timber and livestock management has altered much of the landscape occupied by elk. Recreational use has a major impact on the herd. Hunting accounts for much of the annual adult elk mortality. The core area has a high density of roads, and activities such as off-roading, deer and bird hunting, antler hunting, horseback riding, hiking, etc. greatly influences the distribution of elk. Elk seek refuge from disturbance in the

Coffin Reserve summer through fall where forage may be limited. In the spring, elk concentrate in remote areas or on private lands when large numbers of people descend on winter range

looking for antlers. Agricultural and horticultural crops attract elk to the periphery of the herd area where they tend to cause damage.

Other Ungulates

Mule deer (*Odocoileus hemionus*) use the entire range of the Colockum elk herd. Mountain goats (*Oreamnos americanus*) occupy portions of the high-elevation rugged terrain in GMU's 249, 251 and 335. California bighorn sheep (*Ovis canadensis californiana*) occur primarily along the breaks of the Columbia River in GMU's 251 and 329. Domestic horses, cattle, and sheep are common throughout much of the area. Exact numbers of domestic animals are unknown, but likely exceed the number of elk during the summer months.

HERD DISTRIBUTION

Historic Distribution

Zooarchaeological data from the Columbia Basin suggest elk were present and utilized by early inhabitants (McCorquodale 1985, Dixon et al. 1996). By the late-1800s elk may have been extirpated from the Region (McCorquodale 1985). The current Colockum elk population developed from the reintroduction of Rocky Mountain elk (*Cervus elaphus nelsoni*) from Yellowstone National Park in 1913 and 1915, which significantly contributed to any remnant animals in the area (Bryant and Maser 1982).

Current Distribution

Most Colockum elk display distinct seasonal migrations. They generally move northwest to higher elevation during summer (Bracken and Musser 1993). With the progression of winter, snow accumulation causes elk to move southeast and use more arid, lower-elevation ranges. Elk are usually concentrated on winter-spring range from mid-November through March. The main concentration of elk is in GMU's 251, 328, 329, 330, and 335 (Map 1). Bracken and Musser (1993) estimated 90% of the Colockum elk winter in an area bounded by Colockum Creek, the Columbia River, Rocky Coulee, and the 1,281 meter (4,200 feet) elevation contour west to Naneum Creek. Small subherds also winter near Cle Elum, between Peshastin and Colockum Creeks, and along the Wenatchee River. The majority of elk summer in the Naneum, Swauk, and Teanaway Drainages. Some of the Cle Elum elk may migrate north, but surveys and casual observations suggest the majority do not make long movements. Bracken and Musser (1993) believed elk wintering between Colockum and Peshastin Creeks probably stayed within GMU's 251 and 249.

The majority of elk summering east of Naneum Creek move into the Aurthur Coffin Game Reserve (ACGR) as soon as hunting starts in early September. The ACGR elk probably start moving toward the area as soon as activity (scouting, setting up camps) begins in August. Roughly 50% of the Colockum herd is thought to be in or around the ACGR by early September. The ACGR is about 5 square miles and does not have enough forage to support the high density

of elk sometimes seeking refuge there. Some of the ACGR elk move to GMU 330, which is not open to modern firearm and muzzleloader general season elk hunting. Elk seeking refuge on ACGR often move off at night to feed and return by sunrise.

The distribution of Colockum elk is managed through hunting. The amount of hunting pressure which is directed toward different sub-populations at various times of the year is determined by the following considerations: (1) maximizing hunting recreation, (2) maintenance of desired elk population level, (3) control of damage to commercial agricultural or horticultural crops, and (4) reduction of competition with mule deer during the winter in Chelan County.

Proposed Distribution

No major change in the distribution of Colockum elk is proposed. The Washington Department of Fish and Wildlife will continue to encourage elk use on public lands south of Highway 2 and discourage elk use of private lands where damage to agricultural areas is a problem. The Washington Department of Fish and Wildlife will continue to discourage elk in the Kittitas and Teanaway Valleys.

HERD MANAGEMENT

History, Current Status, and Management Activities

The main Colockum herd developed from 45 Montana Rocky Mountain elk released near Boylston and driven north at Vantage in 1915 (Pautzke, 1939). In 1939, the Colockum herd was estimated at 300-350. In contrast, the Yakima herd was initiated in 1913 with 50 elk and had expanded to 3,000 by 1939. Elk from the rapidly expanding Yakima herd probably contributed to the Colockum population. There was no mention of damage being an issue for Colockum elk in 1939.

The elk population continued to expand in the 1940's and 50's. Interest in securing elk habitat was also increased. The Colockum Wildlife Area was purchased in the mid 1950's, followed by the Whiskey Dick and Quilomene Wildlife areas in 1966 and 1972-74. Together, these Wildlife Areas total approximately 228 mi². Almost half of this total area is controlled through DNR lease or agreement. Wheat farming on the Colockum Wildlife area was reduced from 1,890 acres in 1986 to about 100 acres today. Most livestock grazing on the Quilomene, Whiskey Dick, and Colockum WRA's was eliminated in 1972, 1980, and late 1990's. The range of the Colockum Elk Herd has a long history of domestic stock use that continues on lands near the WAs.

In the 1960s, the 3,000 acre Coffin Reserve was established in the Colockum Wildlife Area as a refuge for elk. Elk concentrate on and around the Coffin Reserve from spring through early winter when snow pushes them out of the higher elevations. The main concentration occurs during the hunting seasons from September to November. Up to one-half of the Colockum elk herd can be found on the Reserve during the fall based on radio-telemetry data (J. Musser, Wash. Dept. Fish and Wildl., unpubl. data). The impact of the high density of elk has become a concern in recent years. Cattle utilization surrounding the reserve is also high. The combination of a high density of elk and cattle has the potential to influence vegetation and animal health.

West Bar (GMU 330) has also been a semi-reserve since the late 1970's. Elk would concentrate on wheat fields on the ~3,500 acre bar. The unit is bounded mostly by cliff and river. There were times when hunters would push elk across the river to the east where either sex elk were legal. Elk were shot in the river and from the highway. GMU 330 was created to reduce unethical hunting behavior. Large concentrations of elk are not desired during the fall, so small numbers of permits have been used to control elk numbers on West Bar.

In recent years, the emphasis has been on minimizing elk numbers in agricultural areas. Liberal antlerless permits and seasons resulted in a declining herd. To reduce the overall population decline and maintain pressure on depredating elk, archery antlerless harvest was eliminated in the core range of the herd in 2005.

Hunting

Kittitas County had its first either-sex elk hunting season in 1927 (Appendix A). In 1929, harvest was restricted to bulls only. In 1939, Pautzke et al. (1939) estimated the Colockum elk population at 300 to 350 animals. The next either-sex seasons did not occur until 1944, when Chelan County and the Teanaway area of Kittitas County were opened in a special early-December season to address elk damage. In 1951, the special either-sex elk season lasted for 65 days. The first special permit-controlled elk hunting season was established in 1955 in two areas of the Colockum herd with 100 permits each.

From 1940 to 1994, hunting for any antlered bull was allowed during general hunting seasons. This strategy resulted in low post-hunting season bull:cow ratios with few adult bulls in the population. In 1994, the harvest strategy was changed to a spike-only general season with branch-antlered bull hunting limited to special permit.

A review of Appendix A shows a steady progression in complexity of elk hunting seasons from 1927 to the present. We now have seasons for archery, muzzleloader, and modern firearm hunters; general, special and permit-only seasons; stratified or early and late seasons; area tags and various legal animal descriptions. All of these strategies are used to provide maximum hunting opportunity, manage damage, and maintain a healthy and productive elk population.

Elk Surveys

Population and Composition

Surveys prior to 1999 focused on estimating composition (i.e., calf:cow:bull ratios), and therefore provide limited inference to total elk abundance. Most surveys were conducted post-season (January, February, or early March). Ground and aerial surveys were attempted in September, but were found to be of limited utility, especially for estimating bull numbers.

A protocol for estimating the post-hunt elk population using aerial surveys and a sightability model (Unsworth et al. 1994) was established in 1999. Initial surveys returned wide confidence intervals around the estimated population parameters. More precise estimates have been obtained the last few years by increasing the amount of area flown, using previous survey information to better stratify the sampling units, and focusing efforts on higher density units. Post-hunt herd data from the Colockum area 2000-2004 indicated that sampling 70 percent of the units yielded a confidence interval at the herd level that has improved from $\pm 20\%$ of the

estimate in 2000, to $\pm 5\%$ of the estimate in 2004. The precision of estimates of cow numbers and estimates of calf numbers were $\pm 3\%$ and $\pm 10\%$ respectively in 2004.

It is difficult to obtain good estimates of the post-hunt bull population because bull groups in late winter are relatively small in size and have a clumped distribution. Small groups of elk that are not evenly distributed across the landscape and using heavy cover can be difficult to see from the air. Precision of the bull estimates has ranged from $\pm 18\%$ to $\pm 38\%$. The bull estimates represent those animals on the traditional winter range that is routinely surveyed. There are indications that a number of bulls in timbered areas outside the surveyed winter range may be missed.

The landscape encompassing all bull range is widespread and bull groups are small and unevenly distributed, which requires a substantial investment in flight time with minimal return on bull groups sighted. Another confounding factor is survey timing. In the Colockum, surveys conducted during the fall rut seem to be less effective as dominant bulls tending harems are more likely to be seen than subordinate bulls on the periphery.

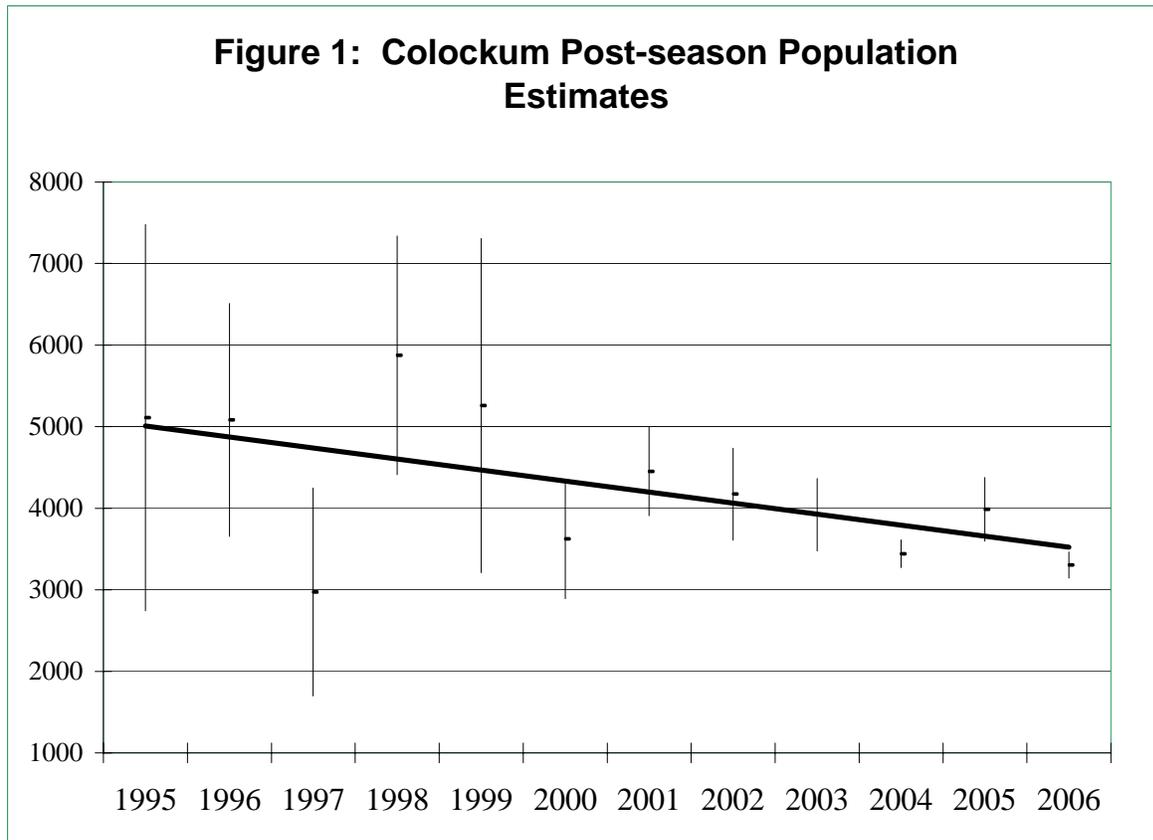
Reproductive performance, body condition, and population status

Determining an elk population objective is difficult. A wide variety of population metrics for elk have been used by western, state wildlife agencies over the years. Cook et al. (2004) documented that there is a positive correlation between elk diet, body condition, and reproductive performance. Cow elk on a high nutritional plane will reproduce consistently from year to year, while those on low nutrition may not even enter estrus. Measuring body condition, pregnancy, and lactation rates should give an indication of where the herd is in relation to carrying capacity. Bracken and Musser (1993) collected reproductive tracts, udders, and fetuses from cow elk to measure reproductive performance. Pregnancy rates were also measured using rectal palpation and blood serum on captured elk in 1987–88. Cook et al. (2001) developed models to predict elk body condition from elk organs. Elk organs and lactation status were collected from hunter-harvested elk for 2002-2005.

Estimated Population Size

A population objective of 4,275 to 4,725 animals was identified for the Colockum elk herd in the Game Management Plan (WDFW 2003). Since 2001, the number of animals estimated on the surveyed winter range has declined (Figure 1). The February 2006 estimate on the surveyed winter range was 3,145 to 3,465 elk. The survey data suggests a declining trend since 1995, but wide variances for estimates prior to 2000 make analysis difficult. Bull harvest (Figure 2) suggests recruitment has declined approximately 40% from historic levels. The decline is probably related to high antlerless harvest and hard winters in the early 1990s.

Figure 1: Population Estimates



Herd Composition

Bull Population/Ratios: Post-season aerial surveys for composition were begun in 1990. Observed bull ratios were 2-4 bulls per 100 cows prior to the 1994 spike-only general season. They increased to 18 in 2002, and decreased to 4 in 2005 (Table 3). As noted previously, the bull population is very difficult to estimate and the estimates have a wide variance (Figure 3). Adult bulls are typically segregated from cows and more difficult to detect (McCorquodale, 2001). Bulls 2+ years and older don't always use traditional winter range and are probably often under-represented in the surveys. Harvest report cards from 1987-93 indicate 100-250 bulls >3 point in the harvest, which had to be alive during post-season surveys the previous winter. Assuming approximately 3,500 cows in the population, the post-season bull ratio prior to 1994 was 3-7 bulls per 100 cows.

From February 1997-2002, the bull segment of the population was likely increasing as recruitment exceeded harvest. Few permits for adult bulls were issued 1996-2000, and no permits 2000-01. In fall 2002, bull permits were issued for the core of the Colockum herd and the bull population started declining. The estimate for adult bulls in 2002 was probably high due to survey stratification errors. Since 2002, surveys have been refined to address potential biases. An extremely light snow pack in 2005 probably resulted in a low estimate as some bulls probably stayed in timber outside the normal winter range. In 2006, conditions were ideal for surveys and a large portion of the range surveyed.

One of the main problems with maintaining an adult bull population is recruitment of yearling bulls through the hunting seasons. The herd has been producing an estimated average of 430 yearling bulls since 2002, but only 60-70 survive the hunting seasons. The majority of the survivors are non-legal (2-3 pt) or had antler characteristics that made it difficult to tell that they were legal game. Natural mortality, accidents, and poaching would reduce the actual recruitment of fully mature bulls to about 50. Damage hunts, general season permits, and tribal harvest had been removing 80-100 adult bulls per year since 2002. While the survey data may not be perfect, the collective data suggest the trend seen in Figure 3 is accurate.

Figure 2: Colockum Antlerless vs. Bull Harvest (1960-2004)

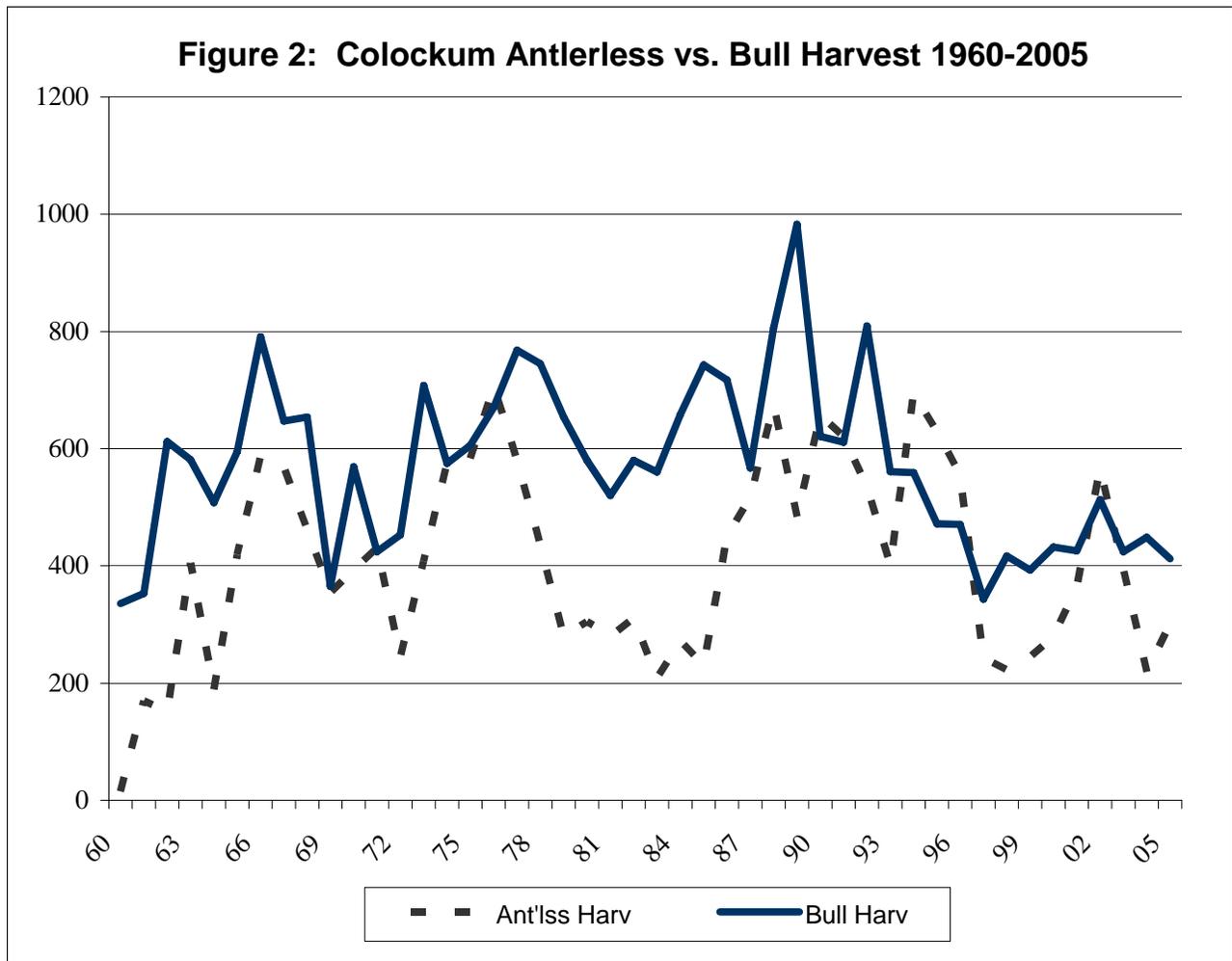
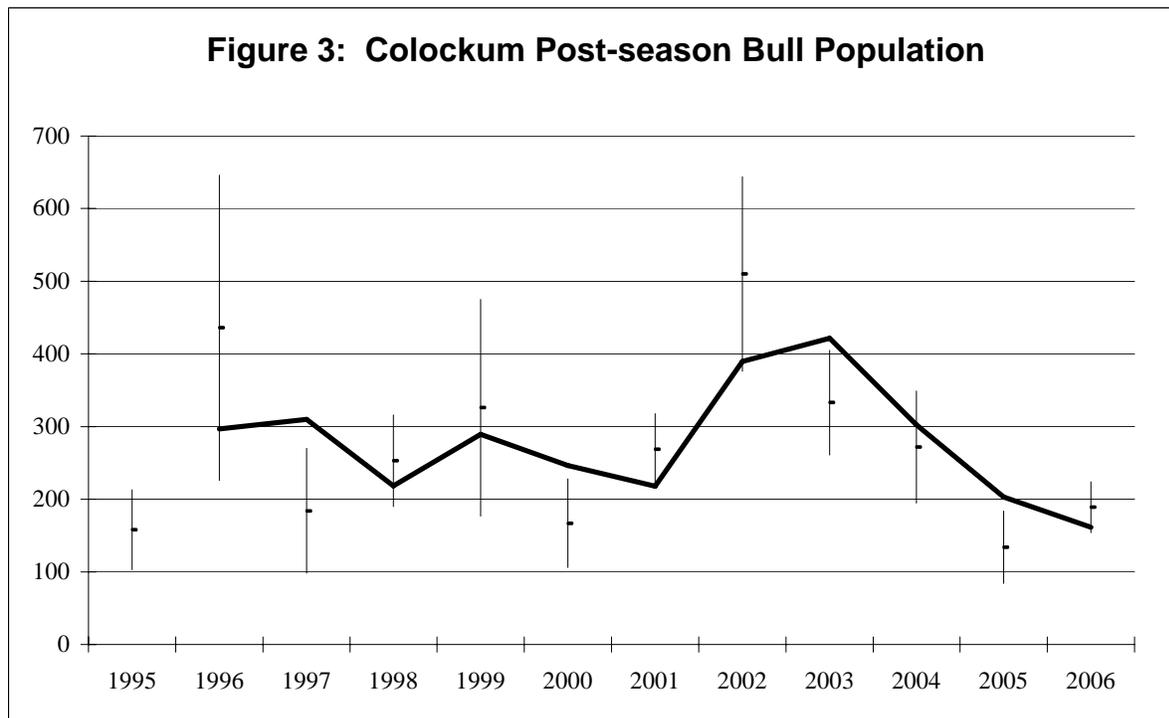


Figure 3: Colockum Post-season Bull Population



Calf Population/Ratios: Calf recruitment is indexed in two ways. Direct counts of calves from the air or ground are made. Typically these data are converted to an index of calves as a ratio of calves per 100 cows (Table 2). In addition, since 1995, WDFW has been able to use these direct counts to estimate the actual calf population (Figure 4). Calf ratios and calf population estimates have declined.

A second way to index calf recruitment is through bull harvest (Figure 2). In a heavily exploited bull population such as the Colockum, the majority of bulls harvested are yearling bulls. While there may be some increases in harvest due to weather, over the long-term, the average harvest of 662 bulls from 1974-1994 should equate to an annual average of at least 1,324 calves produced. Since 1994, harvest has been concentrated on yearling bulls because of spike management. All data suggests that a high proportion (~85%) of the yearling bulls are harvested annually and harvest should index calf recruitment.

In theory, calf estimates should correlate with harvest (i.e., strong calf cohorts should predict high harvests of spike bulls the following fall and weak calf cohorts should predict lower spike harvest). However, the data depict an ambiguous relationship between observed calf ratios and yearling bull harvest (Figure 5) or estimated calf population and harvest (Figure 6). In years when there were major changes in the calf ratio ('92,'93,'00), the yearling bull harvest actually showed an inverse relationship to calf ratio. Since 2000, yearling bull harvest has typically been higher than predicted based on surveys. The confidence intervals on calf population estimates have been fairly narrow and averaged 702 calves from 2000-05. Back-calculating the calf population from spike harvest and spike recruitment suggests the actual calf population is closer to 1,000.

Figure 4: Colockum Post-season Calf Population

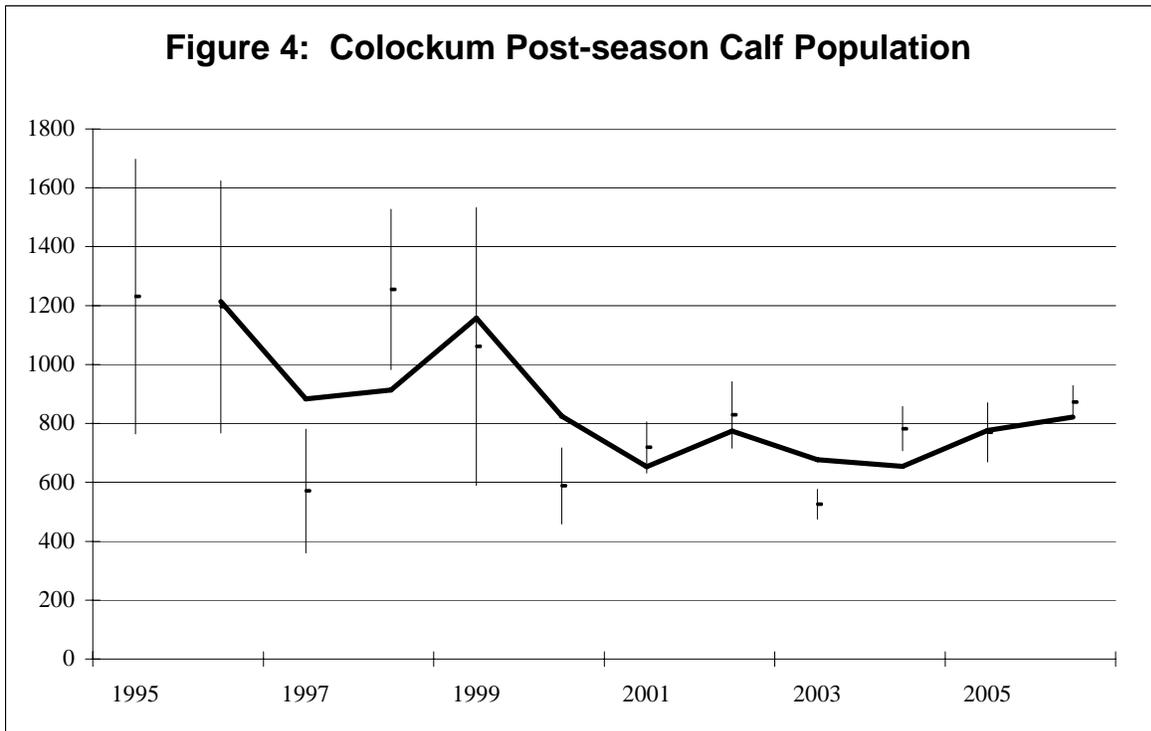


Figure 5: February observed calf ratio compared to fall yearling bull harvest

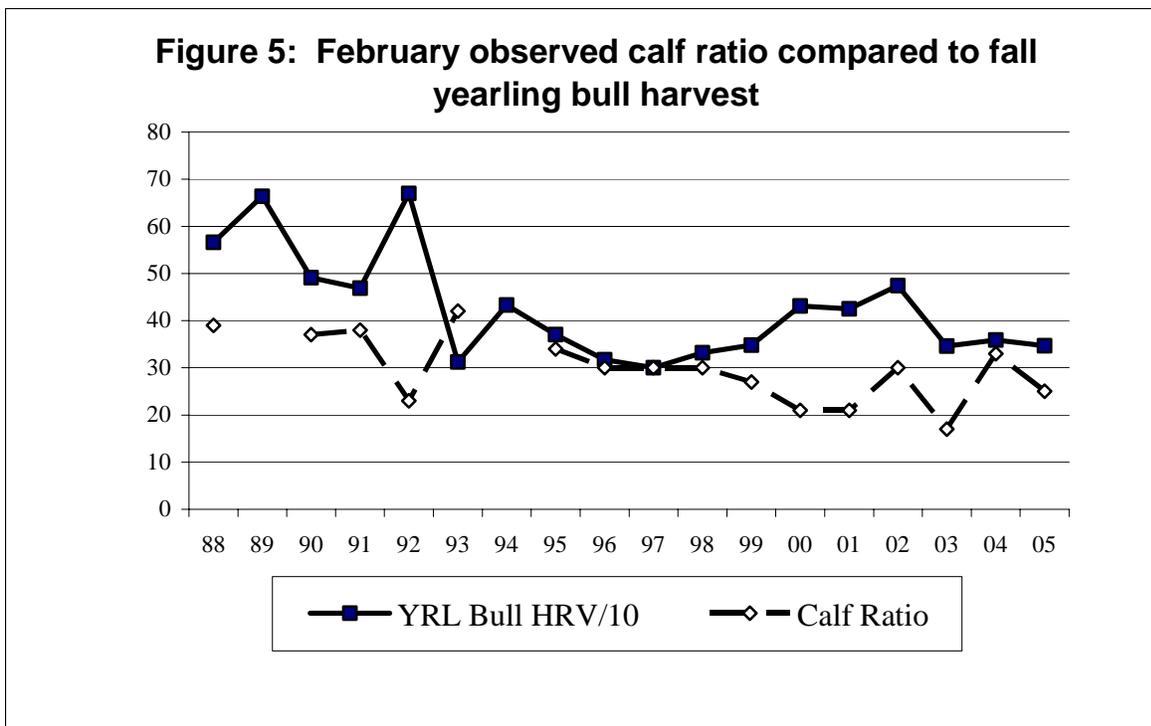
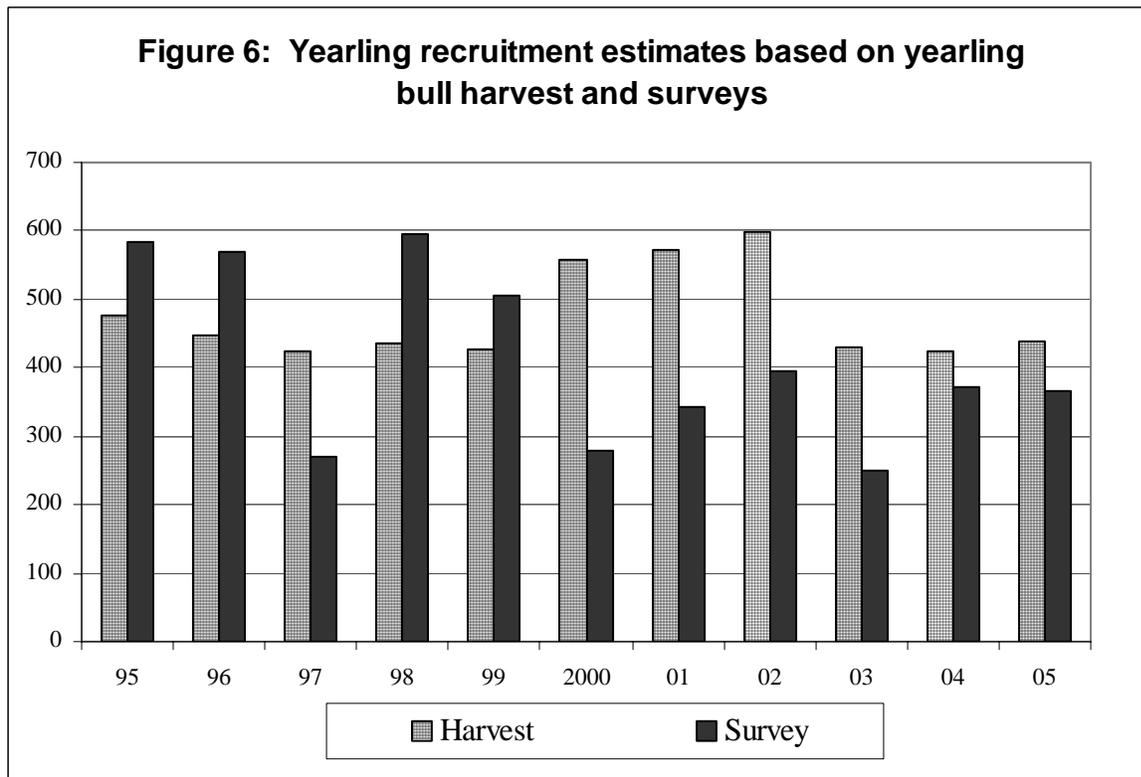


Figure 5: February observed calf ratio compared to fall yearling bull harvest

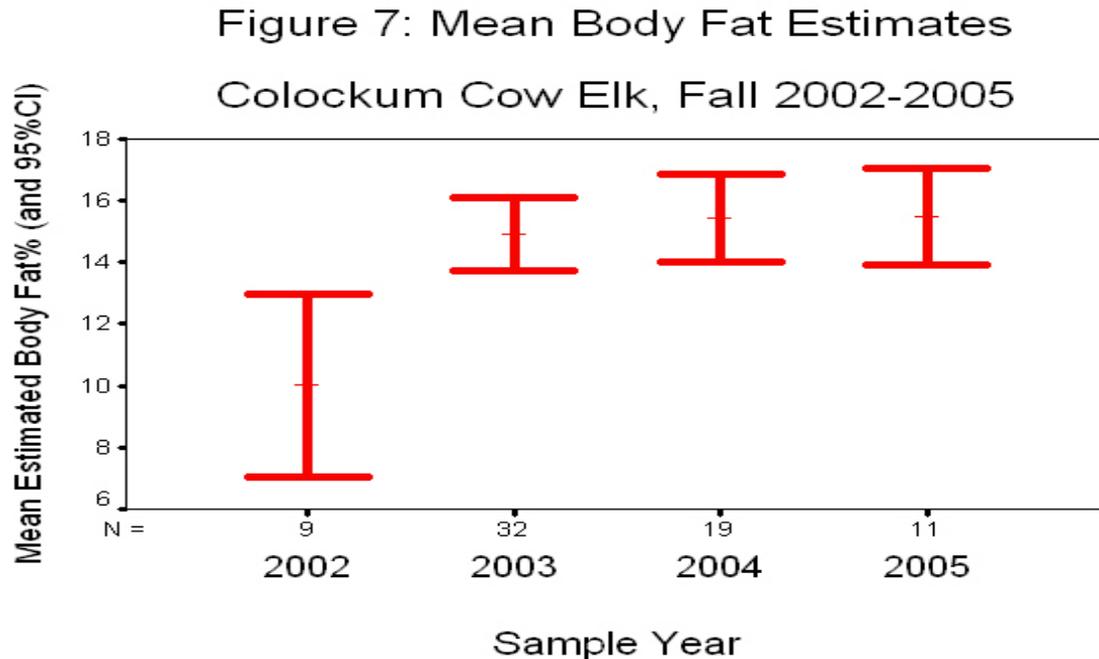
Figure 6: Yearling recruitment estimates based on yearling bull harvest and surveys



There are a number of possibilities for the discrepancies between calf ratios and yearling bull harvest. The calf ratio might have remained stable or increased, while total recruitment decreased because the overall population was decreasing (i.e., high antlerless harvest). Weather can also be a confounding variable by impacting the number of elk on the winter range, harvest (by affecting hunter success), and calf survival. There may be significant numbers of elk wintering outside the surveyed range. While a growing number of elk may be wintering in GMU 335, only 23-29 yearling bulls have been harvested in the area annually since 1999. Elk wintering in GMU 329 do migrate into 335 and contribute to the harvest, which averaged 121 bulls from 1989-94. It is unlikely elk wintering in GMU 335 are migrating east in large numbers and being harvested in GMU 328 and contributing to the harvest discrepancy. Elk wintering in GMU 251, which is also not surveyed could migrate into 328 or 329, but studies to determine potential movements have not been conducted.

Another contributing factor could be systematic misclassification of calves during surveys. Accelerated growth in calves, attributable to environmental variation (i.e., good forage years), could contribute to misclassification. Bonenfant et al. (2005) found young:female ratios were unreliable in estimating actual recruitment in red deer. Cook et al. (2004) found that calves on a high nutritional plane were 40-70% larger than those on a low and medium diet. In years of abundant forage, some calves could be gaining enough mass by February to be classified as adult (yearling) cows. In years of poor nutrition, all the calves may be small and easily classified. Lactation data collected 1987-88 (86% lactating) and 2002-2005 (~70% lactating) suggests the actual calf ratios may be lower than ratios estimated from surveys.

Figure 7: Mean Body Fat Estimates (Fall 2002-2005)



Reproductive performance, body condition and population

Bracken and Musser (1993) estimated 86% of cows >2 years old were lactating and 92% pregnant in fall 1982. In 1988, 95% of elk captured were pregnant with most (72%) conceiving early in the rut. The fall herd was estimated at 6,500 animals (estimate 5,000-5,500 in February based on harvest). The data collected by Bracken and Musser suggested Colockum elk were in excellent condition and one of the most productive herds in the country, despite having the lowest bull:cow ratio.

Lactation rates averaged 66% (milk)-70% (fluid) (N=92) from 2002-2005. The rates are considered good, even though it's lower than the 1980s. Musser and Bracken collected udders, while data from 2002-2005 depended mostly on hunters to report lactation. Field checks 2002-2005 indicated hunter reported lactation rates were low, but the extent of the bias is unknown. Body condition 2002-2005 (Figure 7), suggests cow elk were in good condition from 2003-2005. Cook et al. (2004) found that elk over 10% body fat probably come into estrus. Data 2003-2005 was mostly from elk harvested in early October, although a sub-sample from September 8-9, 2003 indicated elk were in better condition than 2002. There was also a change in domestic grazing from 2002 to 2003 that may have affected forage availability and nutritional status of elk. The long-time cattle lessee ended operation after fall 2002. Cattle did not utilize the majority of the range in 2003, and a new lessee took over in 2004. Photo plots documented an obvious increase in available forage when the range was rested in 2003 that carried over into 2004 and 2005.

Body condition and reproductive performance data suggests the Colockum herd is currently in good condition and getting adequate nutrition from the summer and fall range. More data would

need to be collected later in fall and winter to make a better estimate of carrying capacity, but it appears the goal of 4,275-4,725 elk is reasonable in terms of observed habitat condition.

Mortality

Bracken and Musser (1993) found all Colockum radio collared elk mortalities from 1988-91 were attributed to hunters during the hunting season. Smith et al. (1994) used the same data to calculate annual mortality estimates for bulls and cows of 66% and 13%. Sample sizes were small for sources of mortality other than legal hunting. One bull and cow were killed illegally with modern firearms and one cow died from an archery wound. No deaths were attributed to predation or winter mortality.

Mortality rates in recent years may not be the same as 12 years ago. There is a perception that illegal bull harvest and crippling loss are much higher under spike-only management. Many also believe predation is becoming a factor, particularly by cougars. Smith et al. (1994) determined adult mortality due to natural causes was 9%. Of the 9% natural mortality, only 16% was due to predation. Ballard et al. (2001) found predator control was often ineffective at increasing deer populations or harvest. Ballard et al. recommended that predator control only be considered when populations are well below carrying capacity and predators are known to be a limiting factor. Neither is currently known to be true for Colockum elk.

Harvest

Figure 2 shows the harvest since 1960. It should be noted that changes in harvest estimation probably caused inflated harvest estimated prior to 1984. While fluctuations occurred, the harvest (and theoretically, the population) seems to have gradually increased from 1960-1989. Since 1992, there has been an obvious decrease in bull harvest. Some of the decrease is possibly from spike-only general season, which was implemented in 1994. In 1977, 84% of the antlered harvest was yearlings. Yearling bulls comprised 73% of the Colockum bull harvest from 1987-93 and 84% from 1994-2000. Interestingly, the bull harvest did not decline in 1994 when a “spike only” general season was implemented. The small increase in the 1998 bull harvest was due to a regulation change that allowed muzzleloaders to harvest any bull in a damage area between Ellensburg and Cle Elum. Muzzleloaders reported taking about 140 branched antlered bulls in 1998. The 1997-2001 bull harvest was the lowest 5-year average bull harvest in recent history. Harvest has increased slightly since 1998, but is still well below average.

The reasons for the decline in the late 1990's may have been due to over harvest and hard winters. Prior to 1987, antlerless harvest was relatively low compared to bull harvest (Figure 2), which should have led to an increasing population if herd size was limited by harvest. Bracken and Musser (1993) reported the Colockum herd was one of the most heavily harvested western herds from 1987-91 with low post-season bull ratios and the highest antlerless harvest rate (90 antlerless/100 antlered). Winter mortality in 1992-93 was apparently severe as yearling bull harvest declined from a record high of 670 in 1992 to 312 in 1993. The hard winter was followed by high antlerless harvest from 1992-96 (108 antlerless/100 antlered). Another hard winter hit in 1996-97. The lowest yearling bull harvest in recent history occurred in 1997. The reduction in antlerless harvest may be the reason bull harvest increased 1999-2002. High antlerless harvest in recent years may have again reduced recruitment.

Tribal Hunting

The Yakama Nation has treaty hunting rights within the boundaries of the Colockum Herd. In the 1990's, tribes other than Yakama were also documented hunting Colockum herd elk, but recent court decisions have limited non-Yakama activity. The Yakama's set a year-round elk hunting season for tribal members, but their season is restricted to bull-only from January 1-August 31. WDFW works with the Yakama Tribe to ensure the herd is managed cooperatively. There is considerable interest in tribal harvest of mature bulls from the general public. Tribal harvest for the herd is not available, but it is not believed to be significant relative to non-tribal harvest. Of 25 documented mortalities of radio-collared elk, Bracken and Musser (1993) found only one to be from tribal hunting. Since 2000, non-tribal bull harvest has averaged 443 annually. Field checks, meat locker forms, and population surveys/modeling all suggest tribal harvest is less than 40 animals annually over the last 5 years.

Social and Economic Values

Number of Hunters and Hunter Days

In the 1990's, an average of 10,373 state authorized hunters spent an estimated 50,306 days afield hunting Colockum elk (Appendix B). This represents a decrease of 823 hunters compared to the 1980's average. Hunter numbers seem to have declined further the last 3 years averaging 8,490. The largest decline occurred in 1997 when 33% fewer hunters went after Colockum elk compared to 1996. The decline followed several years of declining harvest, a severe winter, and reduction in special permits.

The Colockum elk herd provides economic value to the State and local communities. The value of elk to the state economy is estimated to be as high as \$1,945 per harvested elk in the Blue Mountains (Meyers 1999). The *2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation* reported that trip-related and equipment expenditures for hunting big game averaged \$925 per hunter (U.S. Department of Interior et al. 2001). Using the \$925 average expenditure per hunter from the national survey, Colockum elk hunters have averaged spending \$7.8 million from 2000-02. It is clear that Colockum elk-centered recreation has considerable economic value and contributes to local community economies.

Hunter participation during any given year is influenced by many factors. During 1984-2000, the Department annually tracked hunter participation and hunter effort through a harvest questionnaire (Table 3). Since 2001, hunter statistics have been tracked through mandatory reporting. Season structure, license and tag fees, climatic conditions, season forecasts, and previous year's hunter success rates, etc. has influenced hunter participation. Similarly, hunter days in the field can be highly variable from one year to the next. The movement of hunters between the Yakima and Colockum herds is very likely.

Harvest Strategies

General hunting seasons are set every three years as a part of the current Washington Fish and Wildlife Commission's policy of adopting hunting seasons for a three-year period and annually establishing permit seasons and necessary amendments to manage populations or control damage. The three-year hunting package serves as the state's harvest plan. Tribal participation

in formulating specific recommendations and harvest strategies begins at the regional level. The WDFW's regional and field personnel meet with tribal representatives periodically to coordinate harvest strategies, share harvest data, and discuss elk management activities.

Elk hunting seasons for the Colockum elk herd prior to 1994 generally allowed archery hunters to take any elk; muzzleloader hunters to take any elk until 1983 and any elk or bull-only depending on the unit during 1984-94 (Appendix A). Modern firearm hunters were restricted to any bull elk with antlerless elk by special permit. These seasons and regulations resulted in low bull escapement. In 1994, the strategy for bull harvest was changed to spike-only general season with branched antlered bulls by permit-only for all hunters. Archery and muzzleloader hunters have seasons that allow for antlerless harvest in designated units and modern firearm antlerless hunting opportunity remains by permit-only.

Hunter density is managed by offering multiple seasons for various weapon types. Washington elk hunters are required to select one elk tag area and hunt with one of three types of weapons (archery, modern firearm, or muzzleloader).

Access Management

The negative effect of roads and human disturbance on elk has been well documented and summarized (Rowland et al. 2005, Wisdom et al. 2005a, Wisdom et al. 2005b). The negative effects include loss of habitat, and increased energy loss and vulnerability to mortality. Peek et al. (2002) in a report to the Washington Fish and Wildlife Commission stated "Most authorities recommend restrictions in human activity to reduce displacement and energy loss in winter..". Phillips et al. (2001) documented that high disturbance levels during the elk calving season, decreased productivity by 27%. Body condition data suggests most Colockum elk should be coming into estrus, but fall lactation rates have decreased ~23% since 1987-88. Colockum harvest data suggests extremely high vulnerability to harvest mortality.

The negative impact of roads generally increases with increased human use (Wisdom et al. 2005a, Pedersen et al. 1980, Perry and Overly 1976). Wisdom et al. (2005b) found ORVs had the greatest negative impact on elk compared to other recreational activity. The avoidance of roads in open habitat is greater. Powell and Lindzey (2003) found elk avoid areas within 1.2 miles of major roads in summer and 0.6 miles in winter in open habitat in Wyoming.

The number of people recreating in the outdoors has increased dramatically in the last 20 years (The Interagency Committee for Outdoor Recreation (IAC) (2003)). Many of the activities overlap. For example, there are now 400,000-500,000 people using off road vehicles (ORVs) in Washington. Many people are using ORVs to get to destinations or participate in hiking or nature activities. The ORVs have made much of the range accessible year round. Snowdrifts and mud used to limit use of the winter range until mid-spring. It is now common to see ORV activity on the range February, March, and April. The late-winter/early spring activity is largely due to people looking for shed antlers.

Increasing recreational use of the Colockum elk is likely disturbing elk and affecting movements. Elk avoiding disturbance on public lands often seek refuge on private lands (Wertz 2001, Burcham et al. 1998). Private landowners around the Colockum herd have noticed such a movement and have requested WDFW address the situation. Wertz (2001) found that by reducing road densities on public lands in Oregon, they were able to get 48% of radio-collared animals to move from private to public land for at least a portion of the season. In the Colockum, reducing road densities and restricting seasonal motorized or all access would likely help keep elk off private lands.

Most of the Colockum elk range has some form of road management in place. The largest of these is the Naneum Green Dot Road Management System, which covers approximately 334 mi². Within this system, open roads are posted with green reflective dots on white posts. All other roads within the system are closed to vehicle travel. However, road densities on much of the Colockum elk herd area probably exceed statewide objectives for road densities set forth in RCW 77.12.210 and WAC 232-12-177. The objectives (≤ 1 mi/mi² on spring and winter range and ≤ 1.5 mi/mi² on summer and fall range) are based on old studies in forested habitat and need to be revised. The high harvest of yearling bulls and movement of animals onto private lands suggest the current system is inadequate. An assessment of current road densities is needed on the Colockum range, as well as the development of a plan for managing on-road and off-road vehicle access.

Damage

Almost since the inception of the modern eastern Washington elk herd in 1913, conflicts with the agricultural industry have occurred. Most historic accounts refer to contention over Yakima and Blue Mountains elk. Few references to problems with Colockum elk were noted prior to about 1970 and no fences have been constructed in the range of Colockum elk to prevent elk damage. Hunters have desired larger elk populations while many agricultural interests desire lower elk numbers. The Washington Department of Fish and Wildlife currently has responsibility to address elk damage complaints (Appendix B). In the Kittitas and Wenatchee Valleys, in 2000 and 2005 damage complaints averaged 12 and 37 respectively, and is becoming a chronic problem. By working with landowners, WDFW enforcement has been able to keep claims to a minimum (Table 4). Officers averaged 37 man-days on Colockum elk complaints/damage 2000-2001. Damage to alfalfa fields, grass, fruit trees, and fences are the most common complaints. In the Kittitas Valley and the Teanaway drainage, elk typically move onto irrigated hay (timothy, alfalfa) fields in August as the range dries. If elk are permitted to stay in the area through fall, damage to a new seeding can be significant. In the winter, as snow depth builds, haystack damage can be a problem. More elk are also moving into the area earlier as antler hunters push elk off public lands. The long elk season in elk area 3911, and the August through February special permit hunts in elk areas 2032 and 2033, have been used to reduce damage. Elk damage control in some portions of the area is getting more difficult as open lands are converted to vacation resorts and residential development with greater restrictions on hunting. Herding elk off of private property is often ineffective, especially if human use of surrounding public lands is high. Some landowners have expressed considerable frustration with the number of elk using the valley areas. Targeting the problem elk with special permits and hunts in elk area 3911 may be

the most effective short-term solution. In the longer term, reducing disturbance and increasing habitat quality on public lands is needed.

A potential major problem is emerging in the southern portion of GMU 335. Recreational and residential development is creating reserves for elk. Some individuals are feeding elk and encouraging animals to reside next to agricultural fields the elk damage. Local Teanaway farmers and ranchers are reporting an increasing elk population. Some of the land that is currently in the Conservation Reserve Program (CRP) may go back into grain production. Muzzleloader and modern firearm antlerless permit holders had relatively poor success in 2003. Hunter access agreements, permits, or special hunts designed to target local animals will probably be needed in the near future.

In the Wenatchee Valley, damage to fruit trees, alfalfa fields, and fences are the most common problems. Landowners report an increasing number of elk in the area. The Malaga and Peshastin permit hunts are designed to address some of the problems. The size and location of damage hunt areas should be adjusted as the need arises. Special landowner permits may be needed to target specific problems. Fencing individual orchards or constructing long drift fences are potential options for reducing damage.

Historically, West Bar has been a source of problem animals. The geography of the bar makes it possible for hunters to drive animals across the river where they become fair game and potentially cause damage in orchards. However, WDFW does not want West Bar to become a reserve. The solution has been to issue small numbers of permits. The permits keep large numbers of elk from gathering on the bar, but the number of hunters small enough so that the elk do not swim the river.

Table 2: Colockum Elk Herd Damage Claimed and Paid (1980-2005)

Year	County	No. Claims	Species	Crops	Total Amount Claimed	Total Amount Paid
2005	Kittitas	5	Elk	Hay, Pasture	\$86,375	
2004	Kittitas	6	Elk	Hay, Pasture	\$13,601	\$10,339
2003	Kittitas	6	Elk	Hay, Oats	\$62,307	\$22,857
2002	Kittitas/Chelan	4	Elk/Deer	Hay, Range, Trees	\$7,738	\$1,585
2001	Kittitas/Chelan	4	Elk/Deer	Hay, Range	\$29,000	\$5,430
2000	Kittitas	3	Elk	Hay	\$4,000	\$1,000
2000's AVG		5			\$33,837	\$8,242
1999	Kittitas	2	Elk	Hay	\$1,550	\$961
1998	Kittitas/Chelan	5	Elk	Hay, Trees	\$3,701	\$2,705
1997	Kittitas/Chelan /Grant	10	Elk/Deer	Hay, Trees	\$187,641	\$12,885
1996	Kittitas/Chelan	2	Elk/Deer	Hay, Trees	\$3,204	\$1,829
1995	None	0			0	0
1994	Kittitas/Chelan	3	Elk	Orchard	\$2,980	\$2,980
1993	Kittitas/Chelan	6	Elk/Deer	Hay, Orchard, Oats	\$30,026	\$6,098

1992	Kittitas/Chelan	3	Elk	Hay, Pasture	\$4,412	\$1,584
1991	Kittitas/Chelan	9	Elk/Deer	Hay, Orchard, Oats	\$41,151	\$42,194
1990	Kittitas	5	Elk	Hay, Oats, Ditch	\$8,352	\$5,520
1990's AVG		4			\$28,302	\$7,676
1989	None	0			0	0
1988	Kittitas/Grant	3	Elk	Hay, Trees, Oats	\$2,975	\$2,955
1987	Kittitas/Chelan	6	Elk	Hay, Orchard, Trees	\$11,561	\$3,314
1986	Kittitas	4	Elk/Deer	Hay, Grain	\$9,990	\$2,490
1985	Kittitas	1	Elk	Grain	\$220	\$220
1984	None	0			0	0
1983	None	0			0	0
1982	Chelan	1	Elk	Orchard	\$800	\$800
1981	Kittitas	1	Elk	Hay	\$425	\$0
1980	Kittitas	2	Elk	Hay, Pasture	\$790	\$790
1980's AVG		2			\$2,676	1,057

Non-consumptive Uses

Viewing elk is becoming an increasingly popular activity, which has a positive impact on local community economies. Wildlife viewing economic contributions to the state's economy exceed \$1 billion per year (U.S. Department of Interior et al. 2001). The IAC (2003) estimated about 18% of Washington residents participated in observing/photographing wildlife and projected a 23% growth in 10 years. Wildlife viewing is often a secondary activity associated with primary trip such as hiking or camping. However, there has been a noticeable increase of people on winter range since 1994. The increase in the numbers of large bulls has encouraged spring "shed-antler hunting" and viewing/photographing as a primary activity. The popularity has raised concern over the harassment of elk.

HABITAT MANAGEMENT

Winter Range

Approximately 80% of the core winter range is in public ownership. The Washington Department of Natural Resources (DNR) owns approximately 30% of the core winter range and has proposed trading these properties for land that has higher income potential. WDFW acquisition of these DNR lands is a high priority.

Slightly over 20% of the core winter range is in private ownership. Unfortunately, a large percentage is in the middle of the winter range, fragmenting the continuity of the public lands. Development is moving into the area. Long-term development of the lands could be detrimental to the stability of the herd and further complicate management. Acquiring either the land or development rights to as much of the private land in the core winter range is a priority.

Cow/calves and adult bulls are somewhat segregated in the winter (McCorquodale, 2001; Bracken and Musser, 1993). Cows and calves are much more likely to winter in the open shrub-steppe than bulls. However, in late winter as green-up occurs, bulls seem to move into similar habitat. The forage on the winter range is mostly seasonal grass, most of which are low in digestibility. Sporadically, adequate fall moisture and temperatures stimulate a fall green-up, providing high quality forage. An effective strategy for elk is to fatten up in the fall, then conserve energy during the winter. On winter range, habitat improvements may be helpful, but limiting disturbance so elk make more effective use of existing forage may be more critical.

Spring/Transition Range

The spring range is a geographically dynamic area that varies with snow conditions and human use. Elk would likely spend more time on winter range if not for the influx of antler hunters. On the south end of the range, large numbers of animals are concentrating on private lands, some of which are just being developed for residential and recreational use. Land conservation measures would be helpful long term. However, the tolerance of the landowners in the area is reaching an upper limit, and many are asking that WDFW reduce spring use of our lands in an attempt to stop the early movement of elk onto private property. Habitat improvements could be helpful if used in conjunction with reduced disturbance.

Summer/Fall Range

Managing the summer/fall range is probably one of the most important factors for the long-term stability of the herd. Most of the damage complaints for the Colockum herd occur during August-October. Elk in good condition in the fall are more likely to breed and survive the winter (Cook et al. 2004). The majority of summer range has four major ownerships with multiple uses.

There are three particularly important factors relating to human activities that affect summer habitat quality for elk: Timber harvest, livestock grazing, and disturbance (open road density). From late summer through fall, approximately half of the Colockum elk are heavily concentrated in and near the ACGR. The majority of the remainder are scattered west, typically in areas of low human use. Only a small portion of the herd remains on the winter range. Recent timber harvest throughout the summer range has produced forage, but reduced security cover, potentially causing even heavier concentrations in the reserve during peak human use. These concentrations have raised concerns over long-term habitat quality in the reserve. The area south, west and east of the reserve has received heavy utilization from sheep and cattle. Range studies suggest a rest rotation grazing system can be beneficial to wildlife (Ganskopp et al. 2004, Danvir and Kearl 1996, Yeo et al. 1993) the Colockum would likely benefit from such a system. The Coffin Reserve is fenced to exclude cattle. Maintaining the fence is costly. The best management may involve closing numerous roads to better disperse the elk and improving forage in and around the reserve. Grazing options that better disperse the cattle, rest pastures, and improve forage quality on WDFW lands should be considered.

The Washington Department of Fish and Wildlife has a partnership in the operation of Mission Ridge winter ski area on the Colockum Wildlife Area. Year-long operation and a summit lodge had been proposed by the owners of Mission Ridge. These requests would have negatively impacted elk and were withdrawn. Proposals have also been submitted for access to the ski area

from the south. While winter use might not impact elk, having a major road through the summer/fall range could have substantial impacts.

Use of Livestock to Improve Forage

Much of the range of Colockum elk has had a long history of livestock use dating from early settlement of the area. At present, there is one livestock-grazing permit issued on a portion of the Colockum WA. While livestock does not currently graze most of the Colockum and Quilomene WAs, the available forage resources are annually utilized by wild ungulates and other wildlife. Off the WA, within the range of Colockum elk, domestic grazing by sheep and cattle is common. Some people have suggested that WDFW should increase the area available for livestock grazing on WAs to improve forage quality. The relationship between elk forage quality and livestock grazing is complicated, and results of research on this relationship are mixed. Some studies have suggested that livestock can have a positive effect on condition (crude protein, digestibility) of forage for elk (Ganskopp et al. 2004, Taylor et al. 2004, Danvir and Kearn 1996, Yeo et al. 1993, Grover and Thompson 1986) when the timing, intensity, and duration of livestock grazing are controlled. Other research (Skovlin et al. 1983, Wambolt et al. 1997, Westenkow-Wall et al. 1994) has failed to find forage improvements or increases. Spring livestock grazing that results in improved nutritional quality of forage also results in reduced fall standing crop (Ganskopp et al. 2004). Livestock can also have a negative influence on vegetation and wildlife (Carrier and Czech 1996, Ohmart 1996) and have frequently been found to displace elk on the range (Coe et al. 2005, Danvir and Kearn 1996, Yeo et al. 1993, Mackie 1970). Any livestock-grazing program aimed at improving forage quality for elk will have to take into account all potential impacts.

RESEARCH NEEDS

1. Refinement of elk population monitoring strategies is needed and would be aided by better data on seasonal elk movements and experimentation on sources of error inherent in current survey methods.
2. Data are needed to better define the interactions between the core Colockum elk herd and developing sub-herds along the periphery of the historical core herd range (e.g., Kittitas Valley, rural Cle Elum, Wenatchee Valley).
3. Data are needed on the dynamics and movements of elk in areas where landowner complaints are becoming chronic.
4. Better data on the effects of human disturbance on seasonal elk movements would be useful in refining strategies to manage elk distribution.
5. Data are needed to evaluate the effects of recent and current livestock herbivory on leased rangelands within the core Colockum elk herd range (i.e., effects of livestock grazing on seasonal elk forage availability and elk movement).
6. Better data on the consequences of elk use of the Arthur Coffin Reserve on elk nutritional dynamics and productivity would be useful in long-term Colockum elk herd management planning.

HERD MANAGEMENT GOALS

The Colockum Elk Herd Plan provides a historical background and current condition of the herd. The plan is an assessment document that identifies management problems, suggests solutions, and sets direction. The plan outlines goals, objectives, problems, strategies, and helps establish priorities for managing the elk herd. It provides readily accessible resource and biological information from the herd and identifies inadequacies in scientific information. Fundamental goals for the management of the Colockum elk herd are to:

1. Preserve, protect, perpetuate, manage, and enhance elk and their habitats to ensure healthy, productive populations and ecosystem integrity.
2. Manage elk for a variety of recreational, educational, and aesthetic purposes, including hunting, scientific study, wildlife viewing, photography, and use by Native Americans.
3. Manage the Colockum elk herd for a sustained yield.

MANAGEMENT OBJECTIVES, PROBLEMS, AND STRATEGIES

Herd Management

Objective #1

Manage for 4,275 to 4,725 elk in the surveyed portion of the winter range, consistent with the Game Management Plan (WDFW 2003).

Problem: The elk population on the core winter range appears to be declining and is below objective.

Strategies:

1. A reduction in antlerless harvest opportunity in the core range is necessary to meet population objectives.
2. Hunting pressure must be kept on damage causing elk, including bulls, in GMU's 335 and Elk Areas 2032, 2033, and 3911.
3. Conduct annual herd composition surveys to determine annual recruitment and estimate population levels.
4. Use harvest data and ground survey data to cross check aerial survey estimates of recruitment.
5. Monitor antlerless harvest and adjust to meet population objectives.
6. If below population objective, attempt to increase recruitment and decrease animals in damage areas through habitat enhancements, hunting seasons, and damage permits.
7. Allow hunting of either sex in select damage areas.

Objective #2

Manage for post-hunting season bull ratios consistent with the Game Management Plan of 12 to 20 bulls per 100 cows post season (WDFW 2003).

Problem: The annual variation in measured bull:cow ratios has been high. The dispersed nature of small, bull groups has led to ambiguity in estimates of bull abundance. Bulls causing damage to orchards must be harvested. Recruitment of yearlings into adult bull class appears to be low.

Strategies:

1. Continue steps to improve surveys designed to measure bull/cow ratios, such as conducting surveys later in the spring over a wider area.
2. Explore using other, independent methods to estimate bull populations and bull survival.
3. Adjust branch-antlered bull permits to obtain goal 12-20 bulls per 100 cows.

Objective #3

Improve elk habitat quality and reduce disturbance of elk.

Problem: Maintaining herd objectives will be difficult if large numbers of elk move onto private lands and cause damage. Improving habitat quality may help keep elk out of agricultural areas, but not if human disturbance is high. Recreational use of the Colockum elk herd area is increasing and may be causing elk to move onto private lands. Road densities exceed optimal levels in many areas and violations of the green-dot road management system are common. Timber harvest has probably reduced security cover, magnifying the impact of increased human use. People looking for antlers may be causing extra winter stress on elk and pushing them off the range prematurely.

Strategies:

1. Look for areas to improve elk forage through clearing, fertilizing, livestock management, and other vegetation management techniques. Consider a CRM within the Wildlife Area Plans.
2. Cooperate with other public land agencies and private landowners to develop a cooperative road management system that addresses the need for security for elk.
3. Close some roads permanently (e.g., gates or tank traps) or maintain seasonal closures of roads during critical periods. Use gates where access for specific uses is needed, such as fire control.
4. As part of the road management plan, address road densities on winter range on the Colockum and Quilomene wildlife areas.
5. Increase enforcement on road management systems and/or potential closures. Emphasize patrols on weekends during spring and winter.
6. Maintain key areas of timber to provide security cover for elk.
7. Identify where on the landscape road density needs to be addressed.
8. Determine which roads should be targeted to best manage road densities to benefit elk, given the limited funding available.

Objective #4

Minimize conflicts caused by the Colockum elk herd and improve Washington Department of Fish and Wildlife relations with landowners.

Problem: Elk damage complaints are a chronic problem. The WDFW is required to address damage complaints. The Enforcement Program has historically been responsible for mitigating elk damage. The response to landowner complaints has been below expectations in some areas due to changes in Enforcement priorities, limited human resources, and funding.

Strategies:

1. Continue to use general seasons and special permits in the three elk damage areas to put pressure on elk that are using private agricultural lands.
2. Where it is justified and can be implemented safely, use hot-spot hunts, kill permits, and/or landowner preference permits to remove elk causing crop damage and other specific damage problems. Adjust seasons, area boundaries, and permits to target problem elk.
3. Implement a program with Wildlife Conflict Specialist positions, which are devoted specifically to resolving wildlife damage problems.
4. Redistribute elk where desirable by reducing human disturbance and increasing habitat quality.
5. Work closely with landowners who are experiencing elk damage to alleviate conflicts. Develop solutions to elk/agriculture conflicts through The Kittitas Big Game Management Roundtable (BGMR) and Coordinated Resource Management Planning (CRMP) process.
6. Provide information to landowners about WDFW cost-share fencing program. Encourage fencing of individual farms to reduce damage problems. Evaluate the feasibility of a drift fence in Kittitas Valley.

Objective #5

Work cooperatively with the Yakama Nation, U.S. Forest Service, Department of Natural Resources, Bureau of Land Management, and private landowners to manage the Colockum elk herd.

Problem: Communication should be improved between the Yakama Nation and the Washington Department of Fish and Wildlife on management of the Colockum elk herd. Other agencies, timber companies, and private individuals control the majority of summer range and access. Successful management of the Colockum elk herd is dependent on good communication among agencies and private landowners.

Strategies:

1. Meet at least once a year with tribal, agency, and private landowner's representatives to review the status of the herd, share management information, and discuss options.
2. Encourage tribal participation in studies and surveys of elk.

3. Continue working with the Big Game Management Round Table and consider developing Private Lands Access Programs to better manage the herd.

Objective #6

Increase public awareness of the Colockum herd and develop elk viewing opportunities.

Problem: Non-consumptive appreciation of elk is becoming more and more popular. Those involved with non-consumptive uses may not realize that their activities may impact the Colockum elk herd, especially during winter and spring.

Strategies:

1. Increase efforts to educate public on management of Colockum elk, especially on how disturbance can negatively affect elk and increase damage.
2. Promote elk viewing that has the least impact, especially to wintering elk.

Objective #7

Conduct research where needed to provide essential data for improving management of the Colockum Herd.

Problem: A number of significant management issues relating to the Colockum elk herd require new or better data for adequate resolution. These needs include refinement of strategies to monitor abundance and structure of the elk herd. Some ambiguity exists in currently available data used to infer trends in productivity of the herd and relative abundance of a harvestable surplus of cows and branch-antlered bulls.

Related to questions about general trends in productivity are questions regarding the effects of concentrating elk use on the Arthur Coffin Game Reserve (ACGR) during hunting seasons on cow elk nutritional condition and calf recruitment. Data on body condition of cow elk that use the ACGR would clarify any negative impacts of the Reserve on herd productivity.

Among the most pressing questions surrounding the Colockum elk herd is uncertainty regarding the relationship between the core population and what appear to be growing subherds in areas peripheral to the historic core range of the herd. Chronic human-elk conflicts may develop and be difficult to manage if these subherds grow and elk avoid areas where general season elk hunting occurs. Management options could be clarified by a better understanding of the movement patterns and interactions of the core Colockum elk and these subherds.

Strategies:

1. Continue to evaluate the geographic scope of the aerial survey design to assure good coverage of the winter distribution of Colockum elk.
2. Experiment with survey replication to evaluate the reliability of the current sightability-based estimation protocol.

3. Explore other means of estimating elk recruitment (e.g., lactation rates from hunter-killed cow elk).
4. Collect data from hunter-killed elk and possibly assess condition of live radio-marked live elk to quantify landscape-referenced nutrition dynamics among Colockum cow elk (e.g., relative to use of the ACGR, public lands, and agricultural lands).
5. Monitor survival of priority sex and age classes in the core elk population.

SPENDING PRIORITIES

The following is a prioritized list of projects and expenses for managing the Colockum elk herd.

Priority #1

Herd Population/Composition Surveys.

The Washington Department of Fish and Wildlife needs to conduct annual population surveys, with the objective of obtaining precise and accurate data on population size and composition.

Post-season surveys: Current post-season aerial surveys require approximately 15 hours of helicopter flight time in order to cover >70 percent of the core winter range. Helicopter charter time has increased 50% in 5 years, while the budget has remained static. There are a number of potential problems with the current surveys. The discrepancy between survey and harvest data raises questions about the accuracy of the surveys. Light winters and increased recreation maybe increasing the percentage of elk residing outside traditional winter range. Surveys have been designed mostly to estimate total population, and may not be accurately estimating bull numbers.

Priority: High - Basic biological data collection is essential for responsible management of the Colockum Elk Herd.

Time-line: Annually

Cost: \$14,000/year; \$70,000 for 5 years (\$450/hr for helicopter)

Priority #2

Reduce burden of elk on private landowners.

The enforcement division has historically been responsible for mitigating elk damage. Changes in priorities and other factors have left the response to landowner complaints below expectations in some areas. Dedicated wildlife conflict specialists should be hired to address landowner complaints. Funds should also be identified to hire herder/hazers to decrease damage claims.

Priority: High

Time-line: Annually

Full-time Control Specialist: \$65,000/year; \$325,000 for 5 years

Seasonal Herder/Hazers: \$17,000/year, \$85,000 for 5 years

Equipment: \$20,000 first year

Cost Share Fencing: \$10,000/year; \$50,000 for 5 years

Priority #3

Range Management

Forage utilization across the range of Colockum elk appears to vary with elk and livestock densities. Cattle interests would like to see more grazing on state lands. The cost of excluding cattle from WDFW lands is fairly high. There may be an opportunity to develop a grazing system that would benefit wildlife and reduce WDFW's cost of maintaining fences. The first step is to document current utilization, then develop a grazing system and measure the change in utilization. The most efficient means of documenting range condition might be through a university run project.

Priority: High

Time-line: 2006-2010

Monitoring Costs: \$25,000 in 2006; \$75,000 for 3 years

Materials for measuring utilization: \$5,000

Priority #4

Access Management

The year round road density and disturbance is higher than desired. The human use is making it difficult to keep elk on public lands. Some roads need to be closed permanently, others seasonally. Enforcing any closures is key to success. One of the most common criticisms of road management is lack of enforcement. Physically closed roads are more effective than posted roads. Flight time, especially in the spring, would greatly aide the enforcement capabilities.

Priority: High.

Time-line: 2007-2010

Develop Road Management Plan: \$65,000

Implement Plan (Gates, Signs, Maps) and Monitor: \$150,000

Priority # 5

Habitat Enhancement

There are various habitat enhancements that have/can take place. These include maintaining meadows, burning, weed control, and fertilizing. Develop a prioritized list of projects and seek partnerships to implement.

Priority: Medium

Time-line: 2006, 2008, 2010

Cost: \$30,000 every other year; \$90,000 for 5 years

Priority #6

Gain management control of critical elk habitat.

Development is moving into areas that have been used by elk historically. As land use changes, elk "refuges" near agricultural lands can develop, limiting ability to control problem elk. Large-scale development has the potential to completely displace elk. Habitat should be secured

through purchases, leases, easements, or incentives. Funds would also be needed for operation and management of these areas. The winter range is a top priority.

Priority: Medium

Time-line: 2003-2008

Cost: The estimated cost is \$1,000,000-\$5,000,000 total.

Priority #7

Elk Study

There are numerous questions that need to be addressed regarding the Colockum herd. Data are needed on: 1) Movements of subherds in relation to damage and contribution to herd objectives; 2) impacts of recreational use on elk distribution; 3) effects of management actions (grazing, habitat improvements, road closures, etc.) on elk distribution; 4) survival of priority sex and age classes; 5) impacts of the ACGR reserve on vegetation and elk.

Priority: Medium

Time-line: 2007-2010

Cost: \$350,000 for 5 years

Plan Review and Amendments

The Colockum Elk Herd Plan is identified as a five-year document subject to annual review and amendment. As new information is gathered and conditions change it will be necessary to maintain a free exchange of communication between the Washington Department of Fish and Wildlife, Yakama Nation, and cooperators. Washington Department of Fish and Wildlife's Regions 2 and 3 will meet on an annual basis to discuss pertinent issues related to the Colockum herd. An annual review meeting with delegates from Tribes will be arranged by the Washington Department of Fish and Wildlife's Region 3 Wildlife Program Manager. Emergent issues can be addressed, as needed either at the technical or policy level.

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APPENDIX A. Elk hunting seasons in the Colockum herd area

Year	GMU # & Permit (#s)	Approx. Dates	Days	Legal Animal	Hunt description and Tag
1927-8	Kittitas County	10/21 – 10/31	11-12	One elk	First elk season
1929-2	Kittitas County	11/01 – 11/05	5-6	One bull elk	
1933-4	Kittitas County	11/01 – 11/10	6-11	1 male / branched antlers	
1935	Kittitas County	11/03 – 11/15	13	1 bull w/ >2" horns	
1936-9	Kittitas County	10/24 – 11/15	7-12	1 male / branched antlers	
1940-2	Kittitas County	10/30 – 11/11	11-13	1 male / visible horns	
1943-4	Chelan & Kittitas counties	11/10 – 11/21	12	1 male / visible horns	
1944	Elk area 4 Chelan/Teaway	12/03 – 12/10	8	Either-sex	Late season elk reduction hunt
1945-6	Chelan & Kittitas counties	11/04 – 11/13	10	1 elk / visible horns	
1946	Chelan Co. special elk season	11/17 – 11/30	14	Either-sex elk	
1947-8	Chelan & Kittitas counties	10/31 – 11/08	7-8	1 bull / visible horns	
1948	Chelan Co. special elk season	10/31 – 11/07	8	Either-sex elk	
1949	Chelan & Kittitas counties	10/31 – 11/07	8	1 bull / visible horns	
	Chelan Co. special elk season	10/31 – 11/07	8	Either-sex elk	
1950-1	Chelan & Kittitas Cos. Colockum	10/29 – 11/05	8	1 bull / visible horns	General hunting season
1951	Chelan Co. special elk season	10/28 – 12/31	65	Either-sex elk	
1952	Chelan & Kittitas Cos. Colockum	11/02 – 11/11	8	bull / visible horns	General hunting season
	Teaway, Chelan Co. N. of Squilhuik – Mission Rd., Kittitas Co. Elk Area 2	11/02 – 12/31 11/02 – 11/11	59 8	Either-sex elk	Open to all elk hunters
1953	Chelan & Kittitas; Chelan County	11/1–11; 11/1 – 12/31	11, 61	Bull, Either-sex elk	General hunting season
1954	Chelan/Kittitas; 5J, Chelan NW of 5J	11/7–14; 11/7–12/31	8, 54	Bull, Either-sex elk	General hunting season
1955	Chelan/Kittitas; 5J, Chelan NW of 5J	11/11–20; 11/11–12/31	10, 50	Bull, Either-sex elk	General hunting season
	Permit areas 4A & 4E (100 ea)	11/21 – 11/23	3	Either-sex elk	Permit Controlled Elk Hunting Season
1956	Chelan/Kittitas; 5J, Chelan NW of 5J	11/10–19; 11/10–12/31	10, 51	Bull, Either-sex elk	General hunting season
	4A & 4E (100-200 ea); Area 3 (150)	11/20 – 22; 12/16 – 18	3	Either-sex elk	Permit Controlled Elk Hunting Season
1957	Chelan/Kittitas; Chelan/Kittitas N. of 4E.	11/09 – 11/17	9	Bull, Either-sex elk	General hunting season
	Area 4 100; 4A & 4E (100-200 ea)	10/04–6; 11/18–20	3	Either-sex elk	Permit Controlled Elk Hunting Season
1958	Unit 4E Naneum	11/17 – 01/31	75	Either-sex elk	Bow and Arrow only season
	Chelan/Kittitas; Teaway/Chelan	11/08–16; 11/17–12/31	9, 45	Bull, Either-sex elk	General season
1959	Chelan/Kittitas; 5J, Chelan NW of 5J	11/1 – 15; 11/16 – 12/31	15, 46	Bull, Either-sex elk	General season
	Unit 4E (200)	11/16 – 11/18	3	Either-sex elk	Permit Controlled Elk Hunting Season
1960	Chelan/Kittitas; 5J, Chelan NW of 5J	11/05 – 11/16	12	Bull, Either-sex elk	General season
1961-4	Chelan/Kittitas; 5J, Chelan NW of 5J	11/04–12; 11/13–12/31	9, 49	Bull, Either-sex elk	General season; both 9 days in 1963
	Unit 4E Naneum (300-400)	11/18 – 11/20	3	Either-sex elk	Permits in 4A w/21 day season in 1964
1965	Unit 4E Naneum	11/28 – 12/13	16	Either-sex elk	Bow and Arrow only season
	Chelan/Kittitas; 5J, Chelan NW of 5J	11/13 – 11/21	9	Bull, Either-sex elk	General season
	Unit 4A Teaway (350)	11/15 – 12/05	21	Either-sex elk	Permit Controlled Elk Hunting Season
1966	Unit 4E Naneum	12/03 – 01/31	60	Either-sex elk	Bow and Arrow only season
	Chelan/Kittitas; 5J, Chelan NW of 5J	11/05–20, 12/3 – 18	16, 16	Bull, Either-sex elk	General season
	Unit 4A, 4E & 4K (500-550)	11/07 – 11/18	12	Either-sex elk	Permit Controlled Elk Hunting Season
1967	Unit 4E Naneum; Elk Area 11 & 12	11/20–12/31; 12/11–17	42, 7	Either-sex elk	Bow and Arrow only season
	Chelan/Kittitas; 5J, Chelan NW of 5J	11/04–19, 12/3–18	16, 16	Bull, Either-sex elk	General season
	Unit 4A, 4E & 4K (500-550)	11/06 – 12/10	5-35	Either-sex elk	Permit Controlled Elk Hunting Season
1968	Unit 4E Kittitas; Chelan	11/20–12/31; 9/7–12/15	42, 99	Either-sex elk	Bow and Arrow only season
	Chelan & Kittitas counties	11/02 – 11/17	16	Bull / visible antler	General season
	Unit 4A, 4E & 4K (500-550)	11/04 – 11/29	5-26	Either-sex elk	Permit Controlled Elk Hunting Season
1969	Unit 4E Kittitas; Chelan	11/29–12/31; 9/7–12/15	33, 99	Either-sex elk	Bow and Arrow only season

Year	GMU # & Permit (#s)	Approx. Dates	Days	Legal Animal	Hunt description and Tag
	Chelan & Kittitas counties	11/01 – 11/16	16	Bull / visible antler	General season
	Elk area 3,4, 5J, Chelan N&W of 5J.	11/29 – 12/31	23-33	Either-sex elk	Open to all hunters
	Unit 4A, 4E & 4K (500-550)	11/03 – 11/28	5-26	Either-sex elk	Permit Controlled Elk Hunting Season
1970	4E; <i>Bow Area 1 Nason Creek</i>	11/28-12/31;9/12-12/20	34, 100	Either-sex	Archery Elk Season
	5J, 4A, 4E, 4K, 4P; <i>Area 3, 4</i>	11/07-22;11/28-12/31	16; 34	Bull, <i>Either-sex elk</i>	Modern Firearm General Elk Season
	4E/4K Kittitas (400)	11/09 – 11/13	5	Either-sex	Modern Firearm Elk Permit Hunts
1971-2	4E; <i>Bow Area 1 Nason Creek</i>	11/20-12/19,9/11-12/19	30, 100	Either-sex	Archery Elk Season
	4A Kittitas (Teaway)	11/15 – 11/21	7	Either-sex	Muzzleloader Elk Season
	5J, 4A, 4E, 4K, 4P; <i>Area 3, 4</i>	11/01-14;11/27-12/31	14;16,35	Bull, <i>Either-sex elk</i>	Modern Firearm General Elk Season
	4E Kittitas (500)	11/03 – 11/06	4	Either-sex	Modern Firearm Elk Permit Hunts
1973	Areas 9; 1, 4E	9/22–30, 9/8-12/26	9,33,100	Bull, <i>Either-sex elk</i>	Archery Elk Season
	ML Area 03 Teaway Area	11/ 22 – 11/30	9	Either-sex	Muzzleloader Elk Season
	5J, 4A, 4E, 4K, 4P; <i>Area 3, 4</i>	11/5-18;12/01-12/31	14;9,31	Bull, <i>Either-sex elk</i>	Modern Firearm General Elk Season
	4E Naneum (650)	11/06 – 11/09	4	Either-sex	Modern Firearm Elk Permit Hunts
1974	Areas 9; 1, 4E	9/14–29, 9/7-12/29	6,37,100	Bull, <i>Either-sex elk</i>	Archery Elk Season
	ML Area 03 Teaway Area	11/ 23 – 11/29	7	Either-sex	Muzzleloader Elk Season
	5J, 4A, 4E, 4K, 4P; <i>Area 3, 4</i>	11/4-17,11/30 – 12/29	14,9,30	Bull, <i>Either-sex elk</i>	Modern Firearm General Elk Season
	4E , Elk 19, Elk 20 (500,150,200)	11/04 – 11/15	4,4,11	Either-sex	Modern Firearm Elk Permit Hunts
1975	Area 9; 20, 328	09/13-10/5,11/22-12/28	23,16,37	Bull, <i>Either-sex elk</i>	Archery Elk Season
	ML Area 03 Cle Elum	11/ 22 – 11/28	7	Either-sex	Muzzleloader Elk Season
	5J, 4A, 4E, 4K, 4P; <i>Area 3, 4</i>	11/03-16,11/29-12/28	14,9,30	Bull, <i>Either-sex elk</i>	Modern Firearm General Elk Season
	328 (450), Elk Area 20 (200)	11/04 – 11/28	4, 25	Either-sex	Modern Firearm Elk Permit Hunts
1976	328, <i>Bow Area 9</i>	11/20-12/31,9/11-10/10	42, 30	Either-sex, <i>Antlered bull</i>	Archery Elk Season
	ML Area 03 Cle Elum	11/ 20 – 11/26	7	Either-sex	Muzzleloader Elk Season
	310 – 332; <i>Area 003, 004</i>	11/1-14;11/27-12/26	14;9,30	Bull, <i>Either-sex elk</i>	Modern Firearm General Elk Season
	328 (400), 332 (150), Area 20 (200)	11/02 – 11/12	4,4,11	Either-sex	Modern Firearm Elk Permit Hunts
1977	328, <i>Bow Area 9</i>	11/19-12/31, 9/10-10/9	43, 30	Either-sex, <i>Antlered bull</i>	Archery Elk Season
	ML Area 03 Lookout Mt.	11/ 19 – 11/21	3	Either-sex	Muzzleloader Elk Season
	310 – 332; <i>Area 003, 004</i>	10/31-11/13,11/26–2/25	14;9,30	Bull, <i>Either-sex elk</i>	Modern Firearm General Elk Season
	328 (400), 332 (75), Area 20(200)	11/01 – 11/11	4,4,11	Either-sex	Modern Firearm Elk Permit Hunts
1978	328, <i>Bow Area 9</i>	11/23–12/17, 9/9–10/8	55	Either-sex	Archery Elk Season
	ML Area 03 Lookout Mt.	11/ 25 – 12/03	9	Either-sex	Muzzleloader Elk Season
	310-332, <i>Area 033, 003, 004</i> Elk Area 003	11/06 – 12/25 11/25 – 12/03	14,5,31 9	Bull with visible antlers Either-sex	Modern Firearm General Elk Season
	328(400), Area 032 & 033 (75ea)	11/07 – 11/10	4	Either-sex	Modern Firearm Elk Permit Hunts
1979	328, <i>Bow Area 9</i>	11/23-12/16, 9/8-10/7	54	Either-sex	Archery Elk Season
	ML Area 10 Cle Elum	11/24 – 12/02	9	Either-sex	Muzzleloader Elk Season (MKWY)
	310-332 (exclude 320), <i>Area 033</i> Elk Area 004; 320	10/29-11/7,10/29 – 11/2 11/24-12/23; 11/4-18	10, 5 30;9,15	Bull with visible antlers Either-sex; <i>Bull</i>	Modern Firearm General Season (K) (Any elk tag); (<i>Y late, X early</i>)
	328 (350), Area 032 (50), <i>Area 033 (75)</i>	10/30 – 11/02	4	Either-sex, <i>Antlerless only</i>	Modern Firearm Elk Permit Hunts (K)
1980-1	328, <i>Bow Area 9</i>	11/22-12/14, 9/6-10/5	53	Either-sex	Archery Elk Season
	ML Area 10 Cle Elum	11/ 22 – 11/30	9	Either-sex	Muzzleloader Elk Season (MKWY)

Year	GMU # & Permit (#s)	Approx. Dates	Days	Legal Animal	Hunt description and Tag
	310-332 (exclude 320), Area 033 Elk Area 004; 320	10/27-11/5; 11/22- 12/21 11/02 - 11/16	12,30 9,15	Bull with visible antlers Either-sex; <i>Bull</i>	Modern Firearm General Season (K) (Any elk tag); (<i>Y late, X early</i>)
	328(275), Elk Area 032,33 (50,150)	10/28 - 10/31	4	Either-sex	Modern Firearm Elk Permit Hunts (K)
1982	328, Bow Area 809	11/20-12/12, 9/8-10/3	49	Either-sex	Archery Elk Season
	324	11/23 - 12/05	13	Either-sex	Muzzleloader Elk Season (MKWXY)
	314, 328, 329, 334 Elk Area 004 Wenatchee; 320, 324	10/25 - 11/05 11/07 - 12/19	12 30,9,15	Bull with visible antlers Either-sex, Bull	Modern Firearm General Season (K) Modern Firearm General (Y,X)
	328(275), Area 032(100), 330(150)	10/26 - 10/29	4	Either-sex	Modern Firearm Elk Permit Hunts (K)
	328, Bow Area 809	11/19-12/11,9/7-10/2	49	Either-sex	Archery Elk Season
1983	ML Area 910 Cle Elum	11/ 22 - 12/04	13	Either-sex	Muzzleloader Elk Season (MKWXY)
	314, 328, 329, 334 Elk Area 004; 320, 324	10/27 - 11/05 12/01-15; 11/6-20	6,10 6,9,15	Bull with visible antlers Either-sex; <i>Bull</i>	Modern Firearm General Elk Season (CL,K) (K or B); (<i>Y,X</i>)
	328 (175), 329 (50); 330 (50), 331 (50)	10/28-31; 10/30- 11/1	4, 3	Either-sex, Antlerless only	Modern Firearm Elk Permit Hunts(K)
	312, 316, 320, 324, 328-335	10/01-05, 10/6-12	12	Bull only, <i>Either-sex</i>	Early Archery Elk Season
1984	314, 328	11/20 - 12/02	11,13	Either-sex	Late Archery Elk Season (any archery tag)
	310, 314; Area 910, 003	10/06-11;11/20-12/15	6,11,26	Bull only, <i>Either-sex</i>	Muzzleloader Season (CM); (<i>CM or YM,CM</i>)
	310, 312, 314, 316, 328, 329, 334 Elk Area 004; 320, 324	10/28 - 11/06 12/01 - 15; 11/1 - 18	6,10 15,9,18	Bull with visible antlers Either-sex, <i>Bull</i>	Modern Firearm General (CL,CB) CE, CL or CM; <i>YL, YE</i>
	328(100), 329(50), 330(50), 331(50)	10/25 - 10/27	3	Antlerless only	Modern Firearm Elk Permit Hunts (CL or CM)
	312, 316, 320, 324, 328-335	10/01-04,10/05-11	11	Bull only, <i>Either-sex</i>	Early Archery Elk Season
1985	314,328	11/19 - 12/01	11,13	Either-sex	Late Archery Elk Season (any archery tag)
	310,314; Area 003, Area 910	10/1-11;11/20-12/15	11;26,15	Bull; <i>Either-sex, Antlerless</i>	Muzzleloader Season(CM);(<i>CM, YM</i>)
	310-316, 328, 329, 334; Area 004 320, 324	10/27-11/5;12/1-15 11/05 - 11/17	7, 9,15 9,12	Bull; <i>Either-sex</i> Bull with visible antlers	Modern Firearm Season CL,CB; <i>CE,CL or CM</i> Modern Firearm General (YL, YE)
	328(100), 329(50), 330(50), 331(50)	10/24 - 10/26	3	Antlerless only	Modern firearm Elk Permit Hunts (CL or CM)
	312, 316, 320, 324, 328-335	10/01-03, 10/4-10	10	Bull only, <i>Either-sex</i>	Early Archery Elk Season
1986	314, 328	11/18 - 11/30	12	Either-sex	Late Archery Elk Season (any archery tag)
	310,314 ML Area 910 Cle Elum	10/01 - 10/10 9/15-10/16,11/18-12/7	10 52	Bull only Antlerless only, Either sex	Early Muzzleloader Elk Season (CM) (CM, YM)
	Elk Area 003, 004	11/18 - 12/15	27,15	Either-sex	Late Muzzleloader Elk Season (CM)
	310,312,314, 316, 328, 329, 334 Elk Area 004 Wenatchee 320, 324	10/26 - 11/04 12/01 - 12/15 11/05 - 11/16	7, 9 15 9,12	Bull with visible antlers Either-sex Bull with visible antlers	Modern Firearm General (CL,CB) CE, CL or CM Modern Firearm General Season (YL, YE)
	328(150), 329(250), 330(75), 331(75)	10/23 - 10/25	3	Antlerless only	Modern Firearm Elk Permit Hunts(CL or CM)
	316,328-35; 314, 328	10/01-16, 11/25-12/6	28	Either-sex	Early Archery Season, <i>Late Archery Elk Season</i>
1987	302,314 ML Area 910 Cle Elum	10/10 - 10/16 9/15-10/16,11/16-12/6	7 53	Bull, Branched antler bull Antlerless only	Muzzleloader Elk Season (CM) (CM, YM)
	Elk Area 003, Elk Area 004	11/16,12/1 - 12/15	30,15	Either-sex	Late Muzzleloader Season (CM), (<i>CM, YM</i>)
	302, 314, 316, 328, 329, 334; 335	10/26-11/4; 11/1-12	7,9;9,12	Bull with visible antlers	Modern Firearm General (CL,CE); (<i>YL, YE</i>)

Year	GMU # & Permit (#s)	Approx. Dates	Days	Legal Animal	Hunt description and Tag
	328(150),329(250),330-31(75 ea),335(50) Elk Area 002 Caribou (250)	10/23-25, 11/13-15 11/21 - 11/30	3 10	Antlerless only Antlerless only	Modern Firearm Elk Permit Hunts(CL or CM) (CL or CM)
1988	316,328-35; 328	10/1-14, 11/23-12/4	26	Either-sex	Archery Elk Seasons (CA, YA in 335)
	302, 314 (portion closed) ML Area 910 Cle Elum	10/08 - 10/14 09/17-10/7, 10/8-14	7 21,7	Bull only Antlerless, Either-sex	Early Muzzleloader Season (CM or YM, CM) (CM, YM)
	Elk Area 003 Kingsbury ML Area 910 Cle Elum	11/16 - 12/15 11/16-25,11/26-12/4	30 10, 7	Either-sex Antlerless, Either-sex	Late Muzzleloader Elk Season (YM) (CM, YM)
	302, 314, 316, 328, 329, 330, 334; 335	10/26-11/4; 11/1-12	7,9;9,12	Bull with visible antlers	Modern Firearm General (CL,CE); (YL, YE)
	328(150), 329(250), 330(25) Area 002 (250), 005 (50)	10/23 - 10/25 11/19 - 11/30	3 12	Antlerless only Antlerless only	Modern Firearm Elk Permit Hunts(CL or BM) (CL or BM)
1989	316, 328-335; 328	9/30-10/13,11/22-12/3	26	Either-sex	Archery Elk Seasons (CA, YA in 335)
	302, 314 (only a portion of) ML Area 910 Cle Elum	10/07 - 10/13 09/16-10/6, 10/7-13	7 21, 7	Bull only Antlerless, <i>Either-sex</i>	Early Muzzleloader Season (CM or YM, CM) (CM, YM)
	Elk Area 003 Kingsbury ML Area 910 Cle Elum	12/02 - 12/10 11/17-26,11/27-12/3	9 10, 7	Antlerless only Antlerless, <i>Either-sex</i>	Late Muzzleloader Elk Season (YM) (CM, YM)
	302, 314, 316, 328, 329, 334; 335	10/25-11/03,11/5-13	9, 9	Bull with visible antlers	Modern Firearm Season (CL, CB; YL, YE)
	314(100), 329 (150) 330 West Bar A, B, C (25 ea) Elk Area 002 Caribou (100)	10/22 - 10/24 10/22, 23, 24 11/18 - 11/21	3 1 4	Antlerless only Antlerless only Antlerless only	Modern firearm Elk Permit Hunts (CL or BM) (CL or CM) (CL or CM)
1990	316, 328, 329, 330, 334, 335	10/6-10/12,9/29-10/12	7,14	Either-sex	Archery Elk Seasons (CA, YA in 335)
	328	11/21 - 12/02	12	Either-sex	Late Archery Elk Season (any archery tag)
	302, 314 (portion of). ML Area 910 Cle Elum Area 003 Kingsbury	10/06 - 10/12 9/15-10/12,11/17-12/ 12/08 - 12/23	7 44 16	Bull only Either-sex Antlerless only	Muzzleloader Seasons (CM or YM, CM) (YM, CM, YM) (YM)
	302,314,316,328,329,334,335	10/24-11/02; 11/5-13	7,9; 6,9	Bull with visible antlers	Modern Firearm Season (CL,CB); (YL, YB)
	314(100), 328(150), 329(150); 030 (75) Elk Area 032 (150), 033 (100) 330 West Bar A,B,C (25 ea) Elk Area 002 Caribou (175)	10/21-23; 10/6-12 09/15 - 10/23 10/21, 22, 23 11/21 - 12/02	3; 7 39 1 12	Antlerless only Antlerless only Antlerless only Antlerless only	Modern Firearm Elk Permit Hunts(CL or CM) (CL or CM) (CL or CM) (CL or CM)
1991	316, 335; 328, 329, 334	09/28-10/11; 10/5-11	14; 7	Either-sex	Early Archery Elk Season (CA), (YA in 335)
	328, 334	11/27 - 12/08	12	Either-sex	Late Archery Elk Season (any archery tag)
	302, 314 (only a portion of) ML Area 910 Cle Elum	10/05 - 10/11 10/5-11; 11/17-12/8	7 29	Bull only Either-sex, <i>Antlerless</i>	Muzzleloader Season (CM or YM, CM) (YM)
	302,314,316,328,329,334; 335	10/23-29; 11/5-13	4,7;6,9	Bull with visible antlers	Modern Firearm Season (CL,CB);(YL, YB)
	316, 302(in Chelan Co)	12/07 - 12/22	16	Antlerless only	Open to Tag Holders CE, CL, CM
	328 Naneum (150) Elk Area 030 A (75), B (75) Elk Area 032 Malaga A (150), B (150) Elk Area 033 Peshastin (100) 330 West Bar A, B,C (25 ea) Elk Area 002 Caribou (175)	10/20 - 10/22 10/05-11, 12/09-15 9/15-10/7, 10/30 -11/6 09/01 - 10/04 10/20, 21, 22 11/20 - 12/01	3 7, 7 7, 23 34 1 ea 12	Antlerless only Antlerless only Antlerless only Antlerless only Either-sex Antlerless only	Modern Firearm Elk Permit Hunts (CL or CM) (CL or CM) (CL or CM) (CL) (CL or CM) (CL or CM)

Year	GMU # & Permit (#s)	Approx. Dates	Days	Legal Animal	Hunt description and Tag
1992	328-330; 316, 335	10/5-14; 10/1-10/14	10, 14	Either-sex	Early Archery Elk Season (CA), (YA in 335)
	328	11/25 - 12/08	14	Either-sex	Late Archery Elk Season (any archery tag)
	302, 314 (only a portion of) ML Area 910 Cle Elum	10/08 - 10/14 10/05-14, 11/17-12/8	7 32	Bull only Either-sex, <i>Antlerless</i>	Early Muzzleloader Season (CM or YM,CM) (CM), (YM)
	302,314,316,328,329,334; 335	10/28-11/3; 11/5-13	4,7; 6,9	Bull with visible antlers	Modern Firearm General (CL, CB); (YL, YB)
	328 (250), 329 (200) Elk Area 033 A (100), B (150) 330 West Bar A, B, C (25 ea) Elk Area 034 Parke Cr. (25)	10/25 - 10/27 9/15-10/7,11/4-20 10/25, 26, 27 11/25 - 12/15	3 23,17 1 22	Antlerless only Antlerless only Antlerless only Antlerless only	Modern Firearm Elk Permit Hunts (CL or CM) (CL or CM) (CL or CM) (CL or CM)
	Elk Area 032 A (200); B (200)	9/15-10/14; 11/4-12/20	30; 47	Antlerless only	Muzzleloader Only Permit Hunts (CM)
1993	316, 335; 328, 329, 330	10/01-14; 10/4-14	14; 11	Either-sex	Early Archery Elk Season (CA), (YA in 335)
	328	11/24 - 12/08	15	Either-sex	Late Archery Elk Season (CA)
	302, 314 (only a portion of) ML Area 910 Cle Elum	10/08 - 10/14 10/04-14; 11/17-12/8	7 33	Bull only Either-sex; <i>Spike/antlerless</i>	Muzzleloader Elk Season (CM, YM; CM) (YM)
	302,314,316,328,329,334; 335	10/27-11/02; 11/5-13	4,7; 6,9	Bull with visible antlers	Modern Firearm General (CL, CB); (YL, YB)
	328 (100), 329 (150) Elk Area 032A (150); 032 B (150) Elk Area 033 A (150), B (150) 330 West Bar A, B, C (25 ea) Elk Area 034(25)	10/24 - 10/26 09/01-10/7; 11/4 - 12/31 9/1-10/7, 11/4-12/31 10/24, 25, 26 11/24 - 12/15	3 76; 58 7,58 1 22	Antlerless only Antlerless; <i>Either-sex</i> Antlerless only Antlerless only Antlerless only	Modern Firearm Elk Permit Hunts (CL or CM)
1994	316; 328, 329, 330, 335	09/01 - 09/14	14	<i>Either-sex</i> ; <i>Spike/antlerless</i>	Early Archery Elk Season (CA), (YA in 335)
	328, 335	11/23 - 12/08	16	Spike bull or antlerless	Late Archery Elk Season (CA), (YA in 335)
	302; 314 (portion of). ML Area 910 Cle Elum	10/06 - 10/12 10/1-12, 11/16-12/8	77 35	Any Bull; <i>Spike bull</i> Spike bull or antlerless	Early Muzzleloader Season (CM, YM); (CM) (YM)
	314,316,328,329; 302, 335	10/26-11/03; 11/5 -15	7/9;8/11	Any bull (304), Spike bull	Modern Firearm Season (CL/CB); (YL/YB)
	316 et al., Chelan (40) 328A(100),329A(200);328B(100),329B(80) Elk Area 032 (150) Area 033 (150) Elk Area 032 (150) Area 033 (150) 330 West Bar A, B, C (25 ea) 302/335 Swauk (60)	10/15 - 11/01 10/23-25; 10/26-11/1 09/01 - 10/06 11/02 - 01/15 10/23, 24, 25 10/25 - 11/13	18 3, 7 36 75 1 ea 19	Any elk Antlerless; <i>Any bull</i> Antlerless only Either-sex Antlerless only Any bull	Modern Firearm Elk Permit Hunts (CL or CM)
	314 Mission (55) ML 910A (75), ML 910B (75)	10/07 - 10/12 10/1-12,11/16-12/8	6 12, 23	Any bull Any elk	Muzzleloader Bull Permit Hunts (CM) (YM)
	328, 329 Colockum (130)	09/01 - 09/14	14	Any elk	Archery Bull Permit Hunts (CA)
	329, Quilomene C (10)	11/01 - 11/13	13	Antlerless only	Persons of Disability Only Permit (CC or CM)
	1995	316; 328, 329, 330, 335	09/01 - 09/14	14	Either-sex; <i>Spike/antlerless</i>
328, 335.		11/22 - 12/08	17	Spike bull or antlerless	Late Archery Elk Season (CA), GMU 335 (YA)
302, 314 (only a portion of) ML Area 910 Cle Elum		10/05 - 10/11 10/1-11,11/16-12/8	7 34	Spike bull Spike bull or Antlerless	Early Muzzleloader Elk Season (CM) (YM)
314, 316, 328, 329; 302, 335		10/26-11/3; 11/5 -15	7, 9;11	Any bull (304), Spike bull	Modern Firearm Season (CL/CB); (YL/YB)

Year	GMU # & Permit (#s)	Approx. Dates	Days	Legal Animal	Hunt description and Tag
	316 et al., Chelan A (20), B (10) 328A(150),329A(225);328B(40),329B(30) Elk Area 032A (150); B (150) Elk Area 033 A (150),B (150) 330 West Bar A, B, C (25 ea) 302/335 Swauk (20)	10/15 - 11/01 10/23-25; 10/26-11/01 09/01-10/6;11/2 - 01/15 09/1-10/6,11/2 -1/15 10/23, 24, 25 10/25 - 11/13	18 3; 7 36; 75 36,75 1 19	Antlerless (A), Any bull (B) Antlerless; <i>Any bull</i> Antlerless only Either-sex , <i>Antlerless</i> (B) Antlerless only Any bull	Modern Firearm Permit Hunts (CP or CM)
	314 (25); ML 910A (30), B (30)	10/1-12, 11/16-12/8	7;12,23	Any bull; <i>Either-sex</i>	Muzzleloader Permit Hunts (CM); (YM)
	328, 329 Colockum (130)	09/01 - 09/14	14	Either-sex	Archery Bull Permit Hunts (CA)
	329, Quilomene C (10)	11/01 - 11/13	13	Antlerless only	Persons of Disability Only Permit (CC or CM)
1996	316, 334; 328, 329, 330, 335	09/01 - 09/14	14	Either-sex; Spike/antlerless	Early Archery Elk Season (CA), (YA in 335)
	328, 335	11/21 - 12/08	18	Spike bull or antlerless	Late Archery Elk Season (CA), GMU 335 (YA)
	314 (only a portion of) ML Area 910 Cl Elum	10/03 - 10/09 9/1-15,11/16-12/8	7 38	Spike bull Spike bull or antlerless	Early Muzzleloader Elk Season (CM) (YM)
	316 (East of Hwy 2)	12/09 - 12/16	8	Either-sex	Open to Specified Tag Holders (CG, CP, CM)
	302, 314, 316, 328, 329, 335; 304, 334	10/26 - 11/03	6, 9	Spike only; <i>Any Bull</i>	Modern Firearm Elk Seasons (CP, CG)
	316 et al., Chelan A (20), B (20) 328A(150),329A(150); 328B(40),329B(30) 032A(150),033B(50);032B(150),033A(75) Elk Area 035 Brushy (75) 330 West Bar A, B, C (25ea) 302, 335 Swauk (20)	10/15 - 11/01 10/23-25;10/26-11/01 A9/1-10/6,B11/2-1/15 9/1-10/6, 11/2-01/15 09/21 - 09/23 10/23, 24, 25	18 3; 7 36,75 75,36 3 1 ea	Antlerless (A), Any bull (B) Antlerless; <i>Any bull</i> Antlerless, <i>Either-sex</i> Antlerless only Antlerless only Any bull	Modern Firearm Elk Permit Hunts (CP or CM)
	314, Mission (25)	10/03 - 10/09	7	Any bull	Muzzleloader Bull Permit Hunts (CM)
	328, 329 Colockum (130)	09/01 - 09/14	14	Either-sex	Archery Bull Permit Hunts (CA)
	329, Quilomene C (10)	11/01 - 11/13	13	Antlerless only	Persons of Disability Only Permit (CP or CM)
1997	334; 328, 329, 335	09/01 - 09/14	14	<i>Any elk</i> ; Spike or antlerless	Early Archery Elk Season (CA), (YA in 335)
	328	11/26 - 12/08	13	Spike bull or antlerless	Late Archery Elk Season (CA)
	314(portion of), 316 ML Area 910	10/04 - 10/10 9/1-14,11/26-12/8	7 27	Spike bull Spike bull or antlerless	Early Muzzleloader Elk Season (CM)Early Muzzleloader Elk Season (YM)
	302(Chelan), 314-329, 335	10/25 - 11/02	9	Spike bull	Modern Firearm Elk Season (CP,CG)
	328A (25), 329A (13)	10/20 - 11/02	14	3 Pt. minimum	Modern Firearm Bull Permit Hunts (CP)
	302,335 Wenatchee Mts. (24) Elk Area 032 A (75), 33 A (25) Elk Area 032 B (75), 33 B (25) Elk Area 035 Brushy (50) 330 West Bar A, B, C (10ea)	10/01 - 10/10 09/01 - 10/03 11/07 - 12/31 09/20 - 09/22 10/22, 23, 24	10 33 21,55 3 1 ea	3 Pt. minimum Antlerless only Antlerless, <i>Any elk</i> Antlerless only Antlerless only	Modern Firearm Elk Permit Hunts (CP or CM)
	328 C (21), 329/330 C (22)	10/01 - 10/10	10	3 Pt. minimum	Muzzleloader Bull Permit Hunts (CM)
	328 D (85), 329 D (68)	09/01 - 09/14	14	3 Pt. minimum	Archery Bull Permit Hunts (CA)
	329 Quilomene E (5)	11/01 - 11/07	7	Antlerless only	Persons of Disability Only Permit (CP or CM)
1998	334; 328, 329, 335	09/01 - 09/14	14	<i>Any elk</i> ; Spike or antlerless	Early Archery Elk Season (CA), (YA in 335)
	328, 335	11/25 - 12/08	14	Spike bull or antlerless	Late Archery Elk Season (CA) GMU 335 (YA)

Year	GMU # & Permit (#s)	Approx. Dates	Days	Legal Animal	Hunt description and Tag
	314 (only a portion of), 316 (S Hwy2) ML Area 910	10/10 - 10/16 08/15 - 09/14	7 31	Spike bull Any elk	Early Muzzleloader Elk Season (CM) Early Muzzleloader Elk Season (YM)
	302,314,316(S Hwy 2),328 ,329, 335	10/31 - 11/08	9	Spike bull	Modern Firearm Season(CG), GMU 335 (YG)
	328 A (19), 329 A (10)	10/25 - 11/08	15	3 Pt. minimum	Modern Firearm Bull Permit Hunts (CG)
	302,335 Wenatchee Mts. (18) Elk Area 032 Malaga A (75), B (75) Elk Area 032 C (75), 033 B (25) Elk Area 033 Peshastin A (25)	10/01 - 10/10 9/1-10/3,10/11-31 11/10 - 12/31 09/01 - 10/03	10 33,21 51 33	3 Pt. minimum Any elk Any elk Antlerless	Modern Firearm Elk Permit Hunts (CG or CM)
	328 C (2), 329/330 C (4)	10/01 - 10/10	10	3 Pt. minimum	Muzzleloader Bull Permit Hunts (CM)
	328 D (77), 329/330 D (23)	09/01 - 09/14	14	3 Pt. minimum	Archery Bull Permit Hunts (CA)
1999	334; 328, 329, 335	09/01 - 09/14	14	Any elk; Spike or antlerless	Early Archery Elk Season (CA), (YA in 335)
	328, 335	11/24 - 12/08	15	Spike bull or antlerless	Archery Elk Season (CA), GMU 335 (YA)
	314, 316 (S of Hwy2) ML Area 911	10/09 - 10/15 08/1409/12;11/24-12/7	7 30; 14	Spike bull Any elk; AHE only	Early Muzzleloader Elk Season (CM)
	302,314,316(S Hwy 2), 328,329, 335	10/30 - 11/07	9	Spike bull	Modern Firearm Season (CF), GMU 335 (YF)
	328 A (21), 329 A (9)	10/24 - 11/07	15	Any bull	Modern Firearm Bull Permit Hunts (CF)
	Elk Area 032 Malaga A (75), B (40)	9/1-10/3,11/10-12/31	33,52	Antlerless	Modern Firearm Permit Hunts (CF or CM)
	328 B (2), 329/330 B (1)	10/01 - 10/10	10	Any bull	Muzzleloader Bull Permit Hunts (CM)
	Elk Area 032 Malaga C (75) 328 C (17), 329/330 C (9)	10/09 - 10/29 09/01 - 09/14	21 14	Antlerless Any bull	Muzzleloader Elk Permit Hunts (CM) Archery Bull Permit Hunts (CA)
2000	334; 328, 329, 335	09/01 - 09/14	14	Any elk; Spike or antlerless	Early Archery Elk Season (EA)
	328, 335	11/22 - 12/08	17	Spike bull or antlerless	Archery Elk Season (EA), GMU 335 (EA)
	ML Area 911	8/19-9/10,11/24-12/7	30,14	Any elk; AHE only	Early Muzzleloader Elk Season (EM)
	250(S of Hwy 2), 251, 328, 329, 335	10/28 - 11/05	9	Spike bull	Modern Firearm Season (EF)
	Elk Area 032 Malaga A (63), B (37)	9/1-10/1,11/11-12/31	31,51	Antlerless	Modern Firearm Permit Hunts (EF or EM)
	Elk Area 032 Malaga C (75)	10/07 - 10/29	23	Antlerless	Muzzleloader Elk Permit Hunts (EM)
2001	249, 250, 334; 328, 329, 330, 335	09/01 - 09/14	14	Any elk; Spike or antlerless	Early Archery Elk Season (EA)
	328, 335	11/21- 12/08	18	Spike bull or antlerless	Late Archery Season (EA)
	249, 250, 251 ML Area 911, 911 AHE only	10/06-12 8/19-9/10, 11/24-30	7 30,14	Any elk Spike bull or antlerless	Early Muzzleloader Elk Season (EM)
	249,250 (S Hwy 2), 251, 328, 329, 335	10/27 - 11/04	9	Spike bull	Modern Firearm Season (EF)
	Elk Area 032 Malaga A (65), B (75) Elk Area 033 Peshastin A (5) GMU 330 A (10), B (10)	9/1-10/1,11/10-12/31 12/01-31 10/22-31,11/01-04	31,51 31 10, 5	Antlerless Any elk Antlerless	Modern Firearm Permit Hunts (EF or EM)
	GMU 330, West Bar C (10) Elk Area 032 D (75); 033 (20)	10/01-12 10/6 - 25; 8/18 - 09/23	12 20, 37	Antlerless Antlerless	Muzzleloader Elk Permit Hunts (EM)
	249, 250, 334; 328, 329, 330, 335	09/01 - 09/14	14	Any elk; Spike or antlerless	Early Archery Elk Season (EA)
2002	328, 335	11/20 - 12/08	18	Spike bull or antlerless	Late Archery Season (EA)
	250; ML Area 911	10/5-11; 8/19 - 9/10	7; 23	Spike bull; Any elk	Early Muzzleloader Elk Season (EM)
	ML Area 911	12/01 - 12/31	31	Spike bull or antlerless	Elk Hunts Open AHE only (EM)
	249,250(S Hwy 2), 251, 328, 329, 335	10/26 - 11/03	9	Spike bull	Modern Firearm General Elk Season (EF)

Year	GMU # & Permit (#s)	Approx. Dates	Days	Legal Animal	Hunt description and Tag
2003	328 A (6), 329 A (8), 335 A (6) 032 Malaga A (75), C (75) 032 Malaga B (10), Malaga E (5) 033 A (20), C (20), E (20) 033 B (5), D (5), F (5) GMU 330 A (10), B (10)	10/21 - 11/03 8/17-9/29,11/4-12/31 9/7-15, 11/11-17 08/17-, 9/16-, 11/30- 08/19-,9/21-,12/7- 10/22-31, 11/01-04	14 34,57 9,7 9,14,44 7,9,37 10,4	Any bull Antlerless Any elk Antlerless Any elk Antlerless	Modern Firearm Elk Permit Hunts (EF) (EF or EM)
	Elk Area 032 F (75), G (10), 330 C (10)	10/08-27(032);10/1-11	20, 11	Antlerless,Any elk,	Muzzleloader Elk Permit Hunts (EM)
	328 C (35), 329C (12), 335C (35)	09/01-14	14	Any bull	Archery Elk Permit Hunts (EA)
	249, 250, 334; 328, 329, 330, 335	09/8 - 09/21	14	Any elk; Spike or antlerless	Early Archery Elk Season (EA)
	328, 335	11/20 - 12/08	18	Spike bull or antlerless	Late Archery Elk Season (EA)
	250, 251, 335	10/04 - 10/10	7	Spike bull	Early Muzzleloader Elk Season (EM)
	AHE Area 3911	8/01 - 2/28	212	Antlerless	AHE (EA, EM, EF)
	AHE 3028 A (40), B (40)	10/4-10; 11/8-14	7 ea	Antlerless	AHE only A=EM, B=EF
	249, 251, 328, 329, 335	10/25 - 11/02	9	Spike bull	Modern Firearm General Elk Season (EF)
	328A(19), 329A(20), 335A (12); B (30) Area 2032 Malaga A (100), C (150) Area 2032 B(5), D(5), E (5), F(5) Area 2033 A (20), C(20), E(20) Area 2033 B (5), D (5), F (5) GMU 330 A (10), B (10)	10/20-11/2; 10/25-11/2 8/16-9/28, 11/3-1/31 9/6-,11/3-,12/13-,1/1- 08/16-,9/16-,11/30- 8/18-,9/21-, 12/15- 10/25-29; 10/30-11/2	14, 9 34,90 16,14,919 10,18,63 8, 9,4 5, 4	Any bull, Antlerless Antlerless Any elk Antlerless Any elk Antlerless	Modern Firearm Elk Permit Hunts (EF)
328B (4), 329B (5), 335B (3) 330C (10); 335D (50)	10/4-10 10/1-10, 10/4-10	7 11, 7	Any Bull Antlerless	Muzzleloader Elk Permit Hunts (EM)	
328 C (35), 329C (12), 335C (35)	09/8-21	14	Any bull	Archery Elk Permit Hunts (EA)	
2004	249, 250, 334; 328, 329, 330, 335	09/8 - 09/21	14	Any elk; Spike Only	Early Archery Elk Season (EA)
	328, 335	11/20 - 12/08	18	Spike Only	Late Archery Elk Season (EA)
	250, Area 2051, 335	10/02 - 10/8	7	Spike bull	Early Muzzleloader Elk Season (EM)
	AHE Area 3911	8/01 - 2/28	212	Antlerless	AHE (EA, EM, EF)
	249, 251, 328, 329, 335	10/30 - 11/07	9	Spike bull	Modern Firearm General Elk Season (EF)
	328A(19), 329A(18), 335A (12) Area 2032 Malaga A (100), C (150) Area 2032 B(10), D(10), E (15) Area 2033 A (20), B(20), D(30) Area 2033 C (5), E (10) 3028 (35); 330 A (5), B (5)	10/25-11/7 8/14-9/26, 11/8-2/28 9/6-, 11/8-, 12/20- 08/16-,9/15-,11/30- 9/22-30,12/15-2/28 10/9-; 10/30-; 11/4-	14 34,113 16,47,113 10,17,91 9, 91 7, 5, 4	Any bull Antlerless Any elk Antlerless Any elk Antlerless	Modern Firearm Elk Permit Hunts (EF)
	328B(4), 329B(5), 335B(3); 330C(5)	10/1-10	11	Any Bull; Antlerless	Muzzleloader Elk Permit Hunts (EM)
	328 C (30), 329C (41), 335C (31)	09/8-21	14	Any bull	Archery Elk Permit Hunts (EA)

APPENDIX B. Wildlife Damage Rules.

RCW 77.36.005

Findings.

The legislature finds that:

(1) As the number of people in the state grows and wildlife habitat is altered, people will encounter wildlife more frequently. As a result, conflicts between humans and wildlife will also increase. Wildlife is a public resource of significant value to the people of the state and the responsibility to minimize and resolve these conflicts is shared by all citizens of the state.

(2) In particular, the state recognizes the importance of commercial agricultural and horticultural crop production and the value of healthy deer and elk populations, which can damage such crops. The legislature further finds that damage prevention is key to maintaining healthy deer and elk populations, wildlife-related recreational opportunities, commercially productive agricultural and horticultural crops, and that the state, participants in wildlife recreation, and private landowners and tenants share the responsibility for damage prevention. Toward this end, the legislature encourages landowners and tenants to contribute through their land management practices to healthy wildlife populations and to provide access for related recreation. It is in the best interests of the state for the department of fish and wildlife to respond quickly to wildlife damage complaints and to work with these landowners and tenants to minimize and/or prevent damages and conflicts while maintaining deer and elk populations for enjoyment by all citizens of the state.

(3) A timely and simplified process for resolving claims for damages caused by deer and elk for commercial agricultural or horticultural products, and rangeland used for grazing or browsing of domestic livestock is beneficial to the claimant and the state.

[1996 c 54 § 1; 2001 c 274 § 1 expired June 30, 2004, pursuant to 2001 c § 5.]

NOTES:

Expiration date -- 2001 c 274 §§ 1-3: "The following expired June 30, 2004:

- (1) Section 1, chapter 274, Laws of 2001;
- (2) Section 2, chapter 274, Laws of 2001; and
- (3) Section 3, chapter 274, Laws of 2001." [2001 c 274 § 5.]

Effective date -- 2001 c 274: "This act is necessary for the immediate preservation of the public peace, health, or safety, or support of the state government and its existing public institutions, and takes effect July 1, 2001." [2001 c 274 § 6.]

RCW 77.36.010

Definitions.

Unless otherwise specified, the following definitions apply throughout this chapter.

(1) "Crop" means a commercially raised horticultural and/or agricultural product and includes growing or harvested product but does not include livestock. For the purposes of this chapter all parts of horticultural trees shall be considered a crop and shall be eligible for claims.

(2) "Emergency" means an unforeseen circumstance beyond the control of the landowner or tenant that presents a real and immediate threat to crops, domestic animals, or fowl.

(3) "Immediate family member" means spouse, brother, sister, grandparent, parent, child, or grandchild.

[1996 c 54 § 2; (2001 c 274 § 2 expired June 30, 2004, pursuant to 2001 c 274 § 5).]

NOTES:

Expiration date -- 2001 c 274 §§ 1-3: See note following RCW [77.36.005](#).

Effective date -- 2001 c 274: See note following RCW [77.36.005](#).

RCW 77.36.020

Game damage control -- Special hunt/remedial action.

The department shall work closely with landowners and tenants suffering game damage problems to control damage without killing the animals when practical, to increase the harvest of damage-causing animals in hunting seasons, and to kill the animals when no other practical means of damage control is feasible.

If the department receives recurring complaints regarding property being damaged as described in this section or RCW [77.36.030](#) from the owner or tenant of real property, or receives such complaints from several such owners or tenants in a locale, the commission shall consider conducting a special hunt or special hunts to reduce the potential for such damage or take remedial action to reduce the potential for such damage. The commission shall authorize either one or two antlerless permits per hunter for special hunts held in damage areas where qualified staff, or designee, have confirmed six incidents of drop damage by deer or elk.

As an alternative to hunting, the department shall work with affected entities to relocate deer and elk when needed to augment existing herds.

[2003 c 385 § 1; 1996 c 54 § 3.]

RCW 77.36.030

Trapping or killing wildlife causing damage -- Emergency situations.

(1) Subject to the following limitations and conditions, the owner, the owner's immediate family member, the owner's documented employee, or a tenant of real property may trap or kill on that property, without the licenses required under RCW [77.32.010](#) or authorization from the director under RCW [77.12.240](#), wild animals or wild birds that are damaging crops, domestic animals, or fowl:

(a) Threatened or endangered species shall not be hunted, trapped, or killed;

(b) Except in an emergency situation, deer, elk, and protected wildlife shall not be killed without a permit issued and conditioned by the director or the director's designee. In an emergency, the department may give verbal permission followed by written permission to trap or kill any deer, elk, or protected wildlife that is damaging crops, domestic animals, or fowl; and

(c) On privately owned cattle ranching lands, the land owner or lessee may declare an emergency only when the department has not responded within forty-eight hours after having been contacted by the land owner or lessee regarding damage caused by wild animals or wild birds. In such an emergency, the owner or lessee may trap or kill any deer, elk, or other protected wildlife that is causing the damage but deer and elk may only be killed if such lands were open to public hunting during the previous hunting season, or the closure to public hunting was coordinated with the department to protect property and livestock.

(2) Except for coyotes and Columbian ground squirrels, wildlife trapped or killed under this section remain the property of the state, and the person trapping or killing the wildlife shall notify the department immediately. The department shall dispose of wildlife so taken within three days of receiving such a notification and in a manner determined by the director to be in the best interest of the state.

[1996 c 54 § 4.]

RCW 77.36.040

Payment of claims for damages -- Procedure -- Limitations.

(1) Pursuant to this section, the director or the director's designee may distribute money appropriated to pay claims for damages to crops caused by wild deer or elk in an amount of up to ten thousand dollars per claim. Damages payable under this section are limited to the value of such commercially raised horticultural or agricultural crops, whether growing or harvested, and shall be paid only to the owner of the crop at the time of damage, without assignment. Damages shall not include damage to other real or personal property including other vegetation or animals, damages caused by animals other than wild deer or elk, lost profits, consequential damages, or any other damages whatsoever. These damages shall comprise the exclusive remedy for claims against the state for damages caused by wildlife.

(2) The director may adopt rules for the form of affidavits or proof to be provided in claims under this section. The director may adopt rules to specify the time and method of assessing damage. The burden of proving damages shall be on the claimant. Payment of claims shall remain subject to the other conditions and limits of this chapter.

(3) If funds are limited, payments of claims shall be prioritized in the order that the claims are received. No claim may be processed if:

(a) The claimant did not notify the department within ten days of discovery of the damage. If the claimant intends to take steps that prevent determination of damages, such as harvest of damaged crops, then the claimant shall notify the department as soon as reasonably possible after discovery so that the department has an opportunity to document the damage and take steps to prevent additional damage; or

(b) The claimant did not present a complete, written claim within sixty days after the damage, or the last day of damaging if the damage was of a continuing nature.

(4) The director or the director's designee may examine and assess the damage upon notice. The department and claimant may agree to an assessment of damages by a neutral person or persons knowledgeable in horticultural or agricultural practices. The department and claimant shall share equally in the costs of such third party examination and assessment of damage.

(5) There shall be no payment for damages if:

(a) The crops are on lands leased from any public agency;

(b) The landowner or claimant failed to use or maintain applicable damage prevention materials or methods furnished by the department, or failed to comply with a wildlife damage prevention agreement under RCW [77.12.260](#);

(c) The director has expended all funds appropriated for payment of such claims for the current fiscal year; or

(d) The damages are covered by insurance. The claimant shall notify the department at the time of claim of insurance coverage in the manner required by the director. Insurance coverage shall cover all damages prior to any payment under this chapter.

(6) When there is a determination of claim by the director or the director's designee pursuant to this section, the claimant has sixty days to accept the claim or it is deemed rejected.

[1996 c 54 § 5.]

RCW 77.36.050

Claimant refusal -- Excessive claims.

If the claimant does not accept the director's decision under RCW [77.36.040](#), or if the claim exceeds ten thousand dollars, then the claim may be filed with the office of risk management under RCW [4.92.040\(5\)](#). The office of risk management shall recommend to the legislature whether the claim should be paid. If the legislature approves the claim, the director shall pay it from moneys appropriated for that purpose. No funds shall be expended for damages under this chapter except as appropriated by the legislature.

[1996 c 54 § 6.]

RCW 77.36.060

Claim refused -- Posted property.

The director may refuse to consider and pay claims of persons who have posted the property against hunting or who have not allowed public hunting during the season prior to the occurrence of the damages.

[1996 c 54 § 7.]

RCW 77.36.070

Limit on total claims from wildlife fund per fiscal year.

The department may pay no more than one hundred twenty thousand dollars per fiscal year from the wildlife fund for claims under RCW [77.36.040](#) and for assessment costs and compromise of claims. Such money shall be used to pay animal damage claims only if the claim meets the conditions of RCW [77.36.040](#) and the damage occurred in a place where the opportunity to hunt was not restricted or prohibited by a county, municipality, or other public entity during the season prior to the occurrence of the damage.

[1996 c 54 § 8.]

RCW 77.36.080

Limit on total claims from general fund per fiscal year -- Emergency exceptions. (Expires June 30, 2004.)

(1) The department may pay no more than thirty thousand dollars per fiscal year from the general fund for claims under RCW [77.36.040](#) and for assessment costs and compromise of claims unless the legislature declares an emergency. Such money shall be used to pay animal damage claims only if the claim meets the conditions of RCW [77.36.040](#) and the damage occurred in a place where the opportunity to hunt was restricted or prohibited by a county, municipality, or other public entity during the season prior to the occurrence of the damage.

(2) The legislature may declare an emergency, defined for the purposes of this section as any happening arising from weather, other natural conditions, or fire that causes unusually great damage by deer or elk to commercially raised agricultural or horticultural crops by deer and elk. In an emergency, the department may pay as much as may be subsequently appropriated, in addition to the funds authorized under subsection (1) of this section, for claims under RCW [77.36.040](#) and for assessment and compromise of claims. Such money shall be used to pay animal damage claims only if the claim meets the conditions of RCW [77.36.040](#) and the department has expended all funds authorized under RCW [77.36.070](#) or subsection (1) of this section.

[1996 c 54 § 9; (2001 c 274 § 3 expired June 30, 2004, pursuant to 2001 c 274 § 5).]

NOTES:

Expiration date -- 2001 c 274 §§ 1-3: See note following RCW [77.36.005](#).

Effective date -- 2001 c 274: See note following RCW [77.36.005](#).

APPENDIX C: September (pre-hunting) and February (post-hunting) composition counts for the Colockum elk herd (1988-2002)

September					February				
Year	Bulls: 100 cows	Adult bulls: 100 cows	Calves: 100 cows	Sample size	Bulls: 100 cows	Adult bulls: 100 cows	Calves: 100 cows	Sample size	
1987-88	29 ^a		66	674	14		39	1,847 ^a	
1988-89	30 ^a		65	556					
1989-90	37 ^a		51	570	3	2	33	1,328	
1990-91	19 ^a		43	429	4	4	38	795	
1991-92	18		51	438	2	0.1	26	1,887	
1992-93					2	0.3	42	2,197	
1994-95	23 ^a	4.7	30	197 ^b	4	3	34	1,656	
1995-96					10	4	30	2,261	
1996-97	24 ^a		39	237 ^b	6	5	30	2,220	
1997-98	25 ^a		58	417	5	2	30	3,809	
1998-99	18 ^a		37	372	8	6	27	1,600	
1999-00					7	5	21	2,348	
2000-01	14	7.5	24	1,521	8	5	21	3,661	
2001-02	20	7.1	37	1,391	18 ^c	14 ^c	30	3,418	
2002-03	15	7.1	25	629	11	8	17	3,358	
2003-04					11	8	33	3,218	
2004-05					4	2	25	3,523	
2005-06					8	5	39	3,263	
^a Surveys from the ground.									
^b Counts based on small samples may not be representative of the population.									
^c In 2002, bull:cow ratios may not have been representative of the population.									

APPENDIX D: Elk harvest and hunter trends for the Colockum elk herd (1985-2001)

Year	Antlered	Antlerless	Total	Hunters	Hunter Days
1960's AVG	544	332	876		
1970's AVG	617	464	1081		
1980	580	305	885		
1981	520	280	800		
1982	580	310	890		
1983	560	208	768		
1984	658	272	930	8,886	36,692
1985	743	231	974	12,266	52,134
1986	717	450	1,167	11,087	46,447
1987	567	581	1,148	10,509	54,761
1988	806	735	1,541	11,543	57,012
1989	983	537	1,520	12,884	61,299
1980's AVG	671	391	1,062	11,196	51,391
1990 ^a	621	681	1,302		
1991	611	657	1,268	13,811	61,598
1992	809	616	1,425	13,253	59,169
1993	561	445	1,006	13,815	62,561
1994	559	741	1,300	11,338	53,154
1995	472	663	1,135	11,371	52,409
1996	471	596	1,067	12,553	54,939
1997	343	268	611	8,388	40,327
1998	496	247	743	9,776	53,563
1999	393	235	628	9,428	65,341
1990's AVG	534	515	1022	10,373	50,306
2000	438	293	731	8,374	37,522
2001	433	398	831	7,660	36,317
2002	436	593	1029	9,436	49,334
2003	424	393	817	7,756	39,571
2004	445	221	666	7,847	38,257

^aHarvest estimated from report cards.

APPENDIX E
Photos



Photo 1: Teanaway Solar Reserve wildlife habitat



Photo 2: Teanaway Solar Reserve wildlife habitat

APPENDIX F

Settlement Agreement with Washington
State Department of Fish and Wildlife
(Pending final review by WDFW)

APPENDIX G

Correspondence from REC Solar, Inc.

February 16, 2010

Howard Trott
Director-Teaaway Solar Project

Hello Howard,

It has been brought to my attention that there are two concerns with the Solar Modules that we propose for the Teaaway Solar project. First, the flammability of the modules, and second, the presence of any hazardous materials that may contaminate local soil and water. I have addressed both of these concerns below, and also attached the specifications sheet for the modules proposed.

To address the flammability of the system, the photovoltaic modules, manufactured by REC Solar AS, which would be utilized on this project are constructed of glass, aluminum and silicon with PTE foil backsheet and EVA encapsulate. Also, all other materials used on the Solar arrays are steel, aluminum and copper. As the primary materials are non-flammable we do not anticipate that modules would be considered a fire hazard during a forest fire.

In regards to potential contamination, the modules are silicon based and do not contain hazardous materials such as cadmium which is used in some other types of solar modules. The modules do contain a small amount of lead solder which is fully encapsulated. Even in the event of damage to the modules, there is no potential for the lead to be released into the environment.

If you have any further questions, please do not hesitate to contact me.

Sincerely,

Chris Oestreich
Director of Engineering
REC Solar, Inc.
coestreich@recsolar.com
805-215-2345

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US - MADE
SILICON



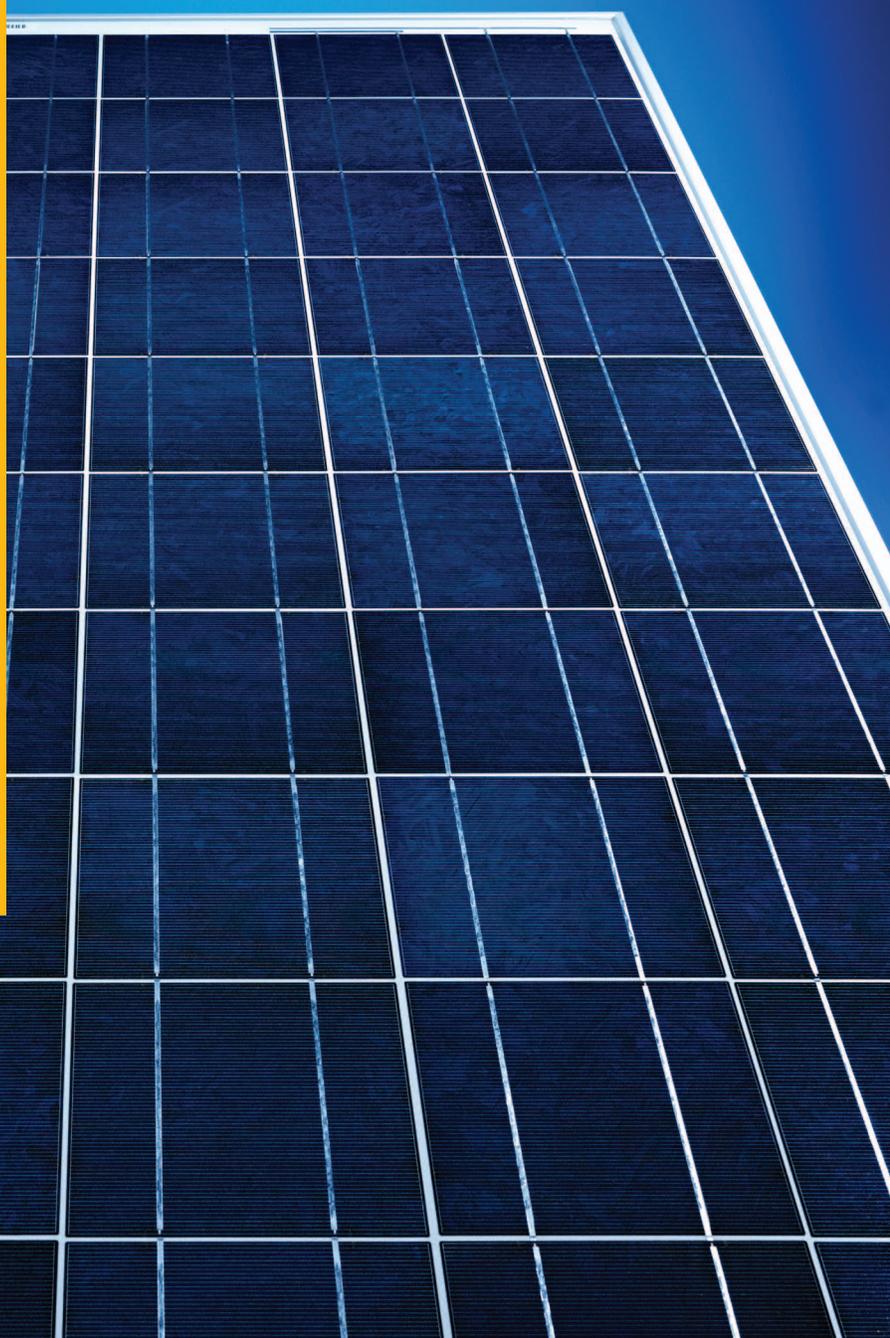
ROBUST AND
DURABLE DESIGN



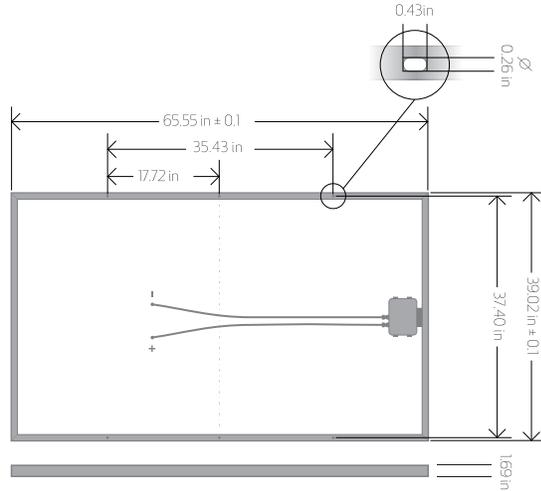
ENERGY PAYBACK
TIME OF ONE YEAR



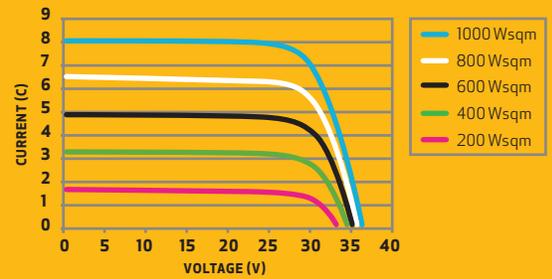
OPTIMIZED ALSO FOR
CLOUDY WEATHER



REC AE-US



IV CHARACTERISTICS 215W MODULE



13.9 EFFICIENCY
63 MONTHS WORKMANSHIP WARRANTY
25 YEAR POWER OUTPUT WARRANTY

ELECTRICAL DATA @ STC

	REC205 AE-US	REC210 AE-US	REC215 AE-US	REC220 AE-US	REC225 AE-US	REC230 AE-US
Peak Power Watts - P_{MAX} (Wp)	205	210	215	220	225	230
Power Output Tolerance - P_{MAX} (%)	±3	±3	±3	±3	±3	±3
Maximum Power Voltage - V_{MPP} (V)	27.2	27.6	28.0	28.4	28.8	29.1
Maximum Power Current - I_{MPP} (A)	7.6	7.6	7.7	7.8	7.8	7.9
Open Circuit Voltage - V_{OC} (V)	36.0	36.1	36.3	36.4	36.6	36.8
Short Circuit Current - I_{SC} (A)	8.3	8.3	8.3	8.4	8.4	8.4
Module Efficiency (%)	12.4	12.7	13.0	13.3	13.6	13.9

Values at Standard Test Conditions STC (Air Mass AM1.5, Irradiance 1000 W/m², Cell temperature 25 °C)

TEMPERATURE RATINGS (230W RATED MODULE)

Nominal Operating Cell Temperature (NOCT)	48.6°C (±2°C)
Temperature Coefficient of P_{MPP}	-0.497%/°C
Temperature Coefficient of V_{OC}	-0.370%/°C
Temperature Coefficient of I_{SC}	0.109%/°C

CERTIFICATION



Certification/Standards
 Certified according to UL 1703 - 3rd edition

CEC/CSI listed

MECHANICAL DATA

Dimensions	65.55" x 39.02" x 1.69"
Area	17.76 ft ²
Weight	48.50 lbs

GENERAL DATA

Cell Type	156 x 156 mm multi-crystalline cells 60 cells in series
Glass	High-transparency solar glass with antireflection surface treatment by Sunarc Technology
Back sheet	PTE foil
Frame	Anodized aluminium
Connectors	2 x 61 in (1.55m) solar cables with MC4 connectors

WARRANTY

10 years limited warranty of 90% power output
 25 years limited warranty of 80% power output
 63 months limited product warranty

MAXIMUM RATINGS

Operational Temperature	-40 ... +176°F [-40 ... +80°C]
Maximum System Voltage	600V
Maximum Load	112 lbs/ft ² (5400 Pa)
Wind Speed	122 mph (safety factor 3, 197 km/h)
Max Series Fuse Rating	15A
Max Reverse Current	15A

Note! Specifications subject to change without notice.

REC is the leading vertically integrated player in the solar energy industry. REC Silicon and REC Wafer are among the world's largest producers of polysilicon and wafers for solar applications. REC Solar is a rapidly growing manufacturer of solar cells and modules, and are also engaging in project development activities in selected segments of the PV market. REC had revenues of NOK 8 191 million and an operating profit of NOK 2 529 million in 2008. Close to 3 000 employees work in REC's worldwide organization.

For further information, contact your local distributor or visit our web site: www.recgroup.com



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