Montana CWD Management:

- **Introduction & Background**
- **Surveillance**
- **Response to a Detection**
- **Public Information Plan**

Photo: Mike Hopper, Kansas Department of Wildlife, Parks and Tourism

A CWD-afflicted white-tailed deer. This animal will die soon.

Montana Fish, Wildlife and Parks CWD Action Team

Draft – October 20, 2017

FWP CWD Mgnt Draft

Table of Contents

CHAPTER 1. INTRODUCTION AND BACKGROUND 1
Authority 2
Background 2
Biology, distribution and population impacts 2
Existing management tools and evidence for their efficacy 4
CWD and human health 5
History of CWD surveillance and planning in Montana 6
Alternative Livestock Operations (Game Farms) in Montana 6
Prevention 7
Baiting and Feeding 7
Scents and Lures 7
Carcass Transport 7
Rehabilitation/Translocation 7
Carcass Disposal 8
People Involved in Developing Montana's CWD Management Plan 8
FWP CWD Action Team Members 8
Montana CWD Citizen Advisory Panel Members 9

CHAPTER 2. MONTANA'S CWD SURVEILLANCE PLAN 10
Priority surveillance areas, minimum surveillance units, and rotation schedule 10
Weighted surveillance, sample size and sampling distribution 11
Sample collection, storage, testing and reporting schedule 14
Surveillance after detecting CWD 14
Estimated Budget 15
Personnel 15
Sample size calculations to detect disease presence with 95% confidence 15

CHAPTER 3. MONTANA'S RESPONSE TO A DETECTION OF CWD 17
Objectives for CWD management 17
Phase I: Initial Response to a New Detection 17

FWP CWD Mgnt Draft

Step 1 – FWP Director, Regional Supervisor/Incident Commander and local F&W Commissioner determine the need for and authorize a Special CWD Hunt, Initial Response Area and Transport Restriction Zone. 17
Defining an Initial Response Area (IRA) 18
Defining a Transport Restriction Zone (TRZ) 18
Step 2 – Begin public information campaign 18
Step 3 – Determine CWD prevalence and distribution within the Initial Response Area (IRA) 18
Establishing a Special CWD Hunt in the Initial Response Area (IRA) 20
Potential complications 22
Step 4 – Evaluate results of Phase I 22
CWD in special buck/bull management hunting districts 22
Phase II: Long-term Management Plan 23
CWD in special buck management hunting districts 23
Evaluation of program efficacy 24
Communication and Educational Outreach 24
Sample size calculations for measuring CWD prevalence 25
Estimated budget for a response to a detection of CWD 25
CWD Response Flow Chart 26

CHAPTER 4. MONTANA CWD PUBLIC INFORMATION PLAN 27
Communication Problem 27
Communication Objective 28
Audience 28
Messages 29
Surveillance and Pre-Detection Speaking Points 29
Response to a Detection Speaking Points 30
Communication Methods, Responsibilities and Timing 31
Action Alert Phone Tree 32
Example FAQs and Example Press Release 33
Example Pre-detection FAQ 33
Example Post-detection FAQ 36

FWP CWD Mgnt Draft

Example News Release 38

LITERATURE CITED 40

List of Tables

Table 1. Table of proposed minimum CWD surveillance units (aggregations or portions of mule deer hunt districts; Figure 1), their estimated population size (2015 estimates), and suggested groupings of units to be visited within the same year. 12

Table 2. The relative weights or "points" associated with each demographic group of deer and elk that count towards meeting a sample size goal using a weighted surveillance strategy based on data from mule deer and elk in CWD-positive areas in Colorado (Walsh & Otis, 2012) and white-tailed deer in Wisconsin's CWD management zone (Jennelle et al., *in review*). 13

Table 3. Weighted sample points needed to detect a specified prevalence (*P*; proportion of the population testing positive) with 95% confidence. 16

Table 4. Sample size needed per species to determine CWD prevalence with a 2% margin of error and 95% confidence in cervid populations of different sizes based on a predicted 5% prevalence..... 19

List of Figures

Figure 1. High priority chronic wasting disease (CWD) surveillance areas for mule deer in Montana. Priority surveillance areas were identified based on proximity to known CWD cases in neighboring states/provinces (red dots) and high relative mule deer densities in Montana based on the work of Russell et al. (2015). The surveillance area encompassing Hunting Districts 210, 212, and 217 surrounds the approximate location of the captive elk facility that tested positive for CWD in 1999. Mule deer hunt districts are displayed. 11

FWP CWD Mgmt Draft

CHAPTER 1.
INTRODUCTION AND BACKGROUND

This document, organized into four chapters, details the 2014 Decision Notice (Montana Fish, Wildlife and Parks 2014) regarding Montana Fish, Wildlife and Parks' (FWP) surveillance plan and response to any new detection of CWD in the state. It draws on existing management plans (Montana Fish, Wildlife and Parks 2005, 2013) but adds significant logistical details for executing the proposed plan. The intent of previous plans and this update are: 1) prevent the introduction of CWD into Montana, 2) limit the spread of CWD when detected in Montana, 3) maintain or reduce the prevalence of CWD in specific locations once detected, and 4) improve communication and educational outreach on CWD with the public, other agencies, and within FWP.

Actions relating to the *prevention* of CWD arriving in Montana have been implemented since 2006. These actions may continue depending on the status of CWD in Montana and any advances concerning the prevention of transmission and potential treatment of CWD. Actions related to the *initial and long-term management* of CWD have been revised, and will be initiated in a localized area around any new detection of CWD in free-ranging Montana deer, elk, moose or caribou (cervids). Plans for *communication and outreach* aim to support FWP's goals of prevention and CWD management, and include ongoing efforts and a detailed communication plan to be implemented following a first or new detection of CWD in Montana's wild herds.

This plan, especially concerning surveillance for CWD and FWP's response to a detection, focuses on mule deer for several reasons:

1. Mule deer are more susceptible to CWD than are elk, white-tailed deer, and moose.
2. Prevalence of CWD in infected mule deer herds tends to be higher and spreads faster than among elk and moose, and perhaps white-tailed deer.
3. Given the proximity of CWD in surrounding states and provinces, mule deer are most likely to be infected before other cervids.
4. Even if CWD is first detected in white-tailed deer, elk or moose, it is extremely likely that mule deer in the area are also infected, and likely at a higher prevalence.

If CWD is detected in elk or moose, FWP's response will likely still focus on mule deer as outlined in Chapter 3; elk and moose will be sampled dependent on each individual circumstance. Response to a detection in a white-tailed deer in a whitetail-dominated ecosystem such as northwest Montana, would be the same as for mule deer outlined in Chapter 3.

This management plan has been assembled with the review and input of the Montana Department of Livestock (DoL) and the Department of Public Health and Human Services

FWP CWD Mgmt Draft

(DPHHS) to address concerns about possible effects on the agricultural community and human health.

This CWD management program is adaptive. It is a living document that can be changed as needed. Changes will be made based on knowledge gained from both Montana's CWD management and ongoing programs in other states/provinces, and as the most effective approaches to CWD prevention and control are identified. An internal FWP "CWD Action Team" will modify this plan through periodic review. In addition, a "CWD Citizen's Advisory Panel" consisting of public stakeholders from across the state representing wildlife and livestock perspectives, scientific and recreation interests, commerce and tourism, and local and state government was formed in Spring 2017. This panel provided input on this updated plan and assisted with communication and educational outreach efforts to the larger public.

AUTHORITY

Several sections of the Montana Code Annotated grant FWP and the Fish and Wildlife Commission (Commission) the responsibility for the management of all wild, native cervids, including the following:

- Mont. Code Ann. (MCA) § 87-1-201(1) grants FWP the authority to "supervise all the wildlife, fish, game, game and nongame birds, waterfowl, and the game and fur-bearing animals of the state…."
- MCA § 87-1-301(1)(a) grants the Commission the authority to "shall set the policies for the protection, preservation, management, and propagation of the wildlife, fish, game, furbearers, waterfowl, nongame species, and endangered species of the state and for the fulfillment of all other responsibilities of the department related to fish and wildlife as provided by law…." Additionally, § 87-1-301(1)(b) provides that the Commission "shall establish the hunting, fishing, and trapping rules of the department(.)"
- MCA § 87-1-304 further grants the Commission the authority to "fix seasons, bag limits, possession limits, and season limits" and to "open or close or shorten or lengthen seasons on any species of game…."

BACKGROUND

<u>Biology, distribution, and population impacts</u>

Chronic Wasting Disease (CWD) is a fatal neurologic disease of elk, deer, moose and caribou for which there is no known cure. It belongs to a group of diseases called transmissible spongiform encephalopathies (TSEs), a group which also includes mad cow disease or bovine spongiform encephalopathy in cattle, scrapie in sheep and Creutzfeldt-Jakob's disease in humans. The causative agent in TSEs is an abnormally folded prion protein (referred to as a "prion") that causes normal cellular prion proteins found in the body to mis-fold into disease-causing forms (Prusiner 1998). Mis-folded prions accumulate in infected animals and cause cell death that eventually leads to fatal nerve and brain damage. CWD prions have been detected throughout

FWP CWD Mgmt Draft

the body of infected individuals, including the brain and central nervous system (Williams 2005), tonsils and lymph nodes (Sigurdson et al. 1999, O'Rourke et al. 2003), saliva and blood (Mathiason et al. 2006, Haley et al. 2011), the intestinal tract, bladder, urine and feces (Tamguney et al. 2009), muscle (Angers et al. 2006), fat (Race et al. 2009), and antler velvet (Angers et al. 2009). CWD is most easily and commonly transmitted by animal-to-animal contact but can also be transmitted by contact with a prion-contaminated environment, such as grass and soil. Infected animals shed prions in saliva, feces, and urine for most of the course of their infection, and via bodily tissues and fluids upon death. These prions may remain infectious in the environment for at least 2 years (Miller et al. 2004). CWD has an average incubation period from infection to clinical signs of approximately 16 months, and the clinical phase may last an additional 4-9 months, culminating in death (Williams and Miller 2002, Williams et al. 2002, Tamguney et al. 2009). There are no documented recoveries from infection.

AT THE END: An elk in the final stages of wasting disease (Beth Williams photo, University of Wyoming)

Although CWD has not yet been detected in free-ranging wildlife in Montana, it was detected in 1999 at a captive game farm outside of Phillipsburg, which was subsequently depopulated. CWD has been detected in wild mule deer, white-tailed deer, elk and moose near Montana's border with North and South Dakota, Wyoming, Alberta and Saskatchewan. To date, CWD has been detected in captive or free-ranging wildlife populations in 24 US states (Colorado, Wyoming, Montana, Utah, New Mexico, Texas, Kansas, Nebraska, Oklahoma, North Dakota, South Dakota, Minnesota, Iowa, Missouri, Arkansas, Wisconsin, Illinois, Michigan, Ohio, Pennsylvania, West Virginia, Virginia, Maryland, and New York), the Canadian provinces of Alberta and Saskatchewan, Norway, and South Korea and continues to expand its range annually. Many of these US states and Canadian provinces have documented the gradual spread of CWD despite attempts at managing it. One common observation is the patchy distribution of infections on the landscape (Conner and Miller 2004, Miller and Conner 2005, Farnsworth et al. 2006, Joly et al. 2006, Osnas et al. 2009, Heisey et al. 2010). Social, matrilineal, or breeding aggregations, habitat refugia, or "hot spots" of environmental contamination may be important amplifiers of transmission that lead to patchy prevalence over the landscape.

Determining the population effects of a disease with such a long incubation period is difficult. Several simulation modeling studies have predicted moderate to dramatic cervid population declines, including local extinction, over long timescales (>20 years) (Gross and Miller 2001, Wasserberg et al. 2009, Almberg et al. 2011). Radio-collaring studies have documented significantly lower survival for deer and elk infected with CWD, and some have measured declines in annual population growth rates (Miller et al. 2008, Monello et al. 2014, Geremia et al. 2015, Edmunds et al. 2016, DeVivo 2015, Samuel and Storm 2016). Recent work from

FWP CWD Mgmt Draft

Wyoming has shown a decline in white-tailed deer buck age structure with CWD (Edmunds et al. 2016)

It is unknown how CWD will affect Montana's cervid populations once it arrives; however, several field studies and computer models suggest that populations could be substantially reduced over time (Gross and Miller 2001, Miller et al. 2008, Wasserberg et al. 2009, Almberg et al. 2011, Monello et al. 2014, Geremia et al. 2015, Edmunds et al. 2016, DeVivo 2015, Samuel and Storm 2016). Documented CWD-related, herd-level declines in mule deer include a 21% annual decline in Wyoming (at 21-27% CWD prevalence; DeVivo 2015, DeVivo et al. 2017) and a 45% decline in Colorado (from 1987-2007 given prevalence of up to 41% in males and 20% in females; Miller et al. 2008). Among white-tailed deer in Wyoming, Edmunds et al. (2016) found a 10% annual decline (given 33% prevalence). Uncertainty remains over the size and extent of any future CWD-associated declines. Because the distribution and intensity of CWD infections appears to be highly variable (Conner and Miller 2004, Miller and Conner 2005, Farnsworth et al. 2006, Joly et al. 2006, Osnas et al. 2009, Heisey et al. 2010), population responses may be expected to be similarly variable across the landscape. However, as noted above, if left unchecked CWD could result in large-scale declines.

Existing management tools and evidence for their efficacy

Once CWD is present in a wild population, it is extremely difficult, if not impossible, to eliminate. New York and perhaps Minnesota may be the only two states to have eliminated a CWD outbreak after its detection; both responded aggressively to what appears to have been very early and small outbreaks (Miller and Fischer 2016). Typically, CWD is discovered after it has been established for some time. The approximately 16-month incubation period, during much of which an animal is infectious and shedding potentially long-lived prions into the environment, makes it difficult to detect an emerging epidemic before it is well established.

There are currently no effective treatments or vaccines for CWD. Prevention is critical to the control of CWD over large landscapes. Preventative tools include restricting the transport of carcasses from CWD-infected areas or states, banning the transport or translocation of wild cervids, and requiring the responsible disposal (e.g. incineration or disposal in certified landfills) of carcasses from infected regions. Many states also restrict the baiting and feeding of wild cervids to help limit artificial aggregations that might facilitate more rapid disease transmission.

Despite the low likelihood of eliminating CWD from a wild population, there are several promising tools for slowing or controlling its spread and prevalence. To date, many states have attempted a combination of population density reduction, disease "hot-spot" culling and reducing large aggregations of cervids. Contact rate, and hence transmission rate, is often thought to be positively related to population density; however, due to cervid social behavior and the potential for transmission of CWD via the environment, this may not always be the case (Storm et al. 2013, Potapov et al. 2013). Thus, population density reductions alone may have only modest impacts on maintaining or reducing CWD prevalence. "Hot-spot" culling, the strategic removal of animals from a local area, uses public hunting and/or agency staff to

FWP CWD Mgmt Draft

dramatically reduce cervids in a restricted portion of a population or geographic region centered around known CWD infections. The goal is to remove a cluster of infected animals and thereby reduce prevalence in the larger population. Another approach to reduce contact rates and transmission is to reduce large aggregations of cervids (i.e. large compact herds) either by eliminating food attractants (e.g. fencing haystacks), changing habitat structure, or through hunting pressure.

Computer simulation models have been used to explore additional options for controlling CWD. Most recently, several studies have predicted that increasing male harvest and reducing male to female sex ratios in cervids may be one of the most effective tools for reducing CWD prevalence (Jennelle et al. 2014, Potapov et al. 2016). Male deer are 2-3 times more likely to be infected than females, presumably due to behavioral differences, and thus targeting males may be an efficient way to reduce overall transmission. While anecdotal evidence from several jurisdictions may provide support for this hypothesis, it has yet to be tested experimentally. Furthermore, natural predation, particularly by selective predators, has been predicted to help stabilize or reduce CWD prevalence (Miller et al. 2008, Wild et al. 2011).

Research from Wisconsin, Illinois, and Colorado suggests that combinations of some of these management tools may indeed help maintain or reduce CWD prevalence. Wisconsin attempted aggressive population reductions from 2003 to 2007, during which CWD prevalence remained relatively stable (Heisey et al. 2010); however, when agency-led culling was stopped because of public opposition (Holsman et al. 2010), prevalence increased (Heisey et al. 2010, Manjerovic et al. 2014). In contrast, neighboring Illinois continued population reduction and hot-spot culling, and CWD prevalence remained stable (Manjerovic et al. 2014, Mateus-Pinilla et al. 2013). Similarly, work by Geremia et al. (2015) in Colorado suggests that population density reductions and hot-spot culling may have contributed to declines in CWD prevalence in some herds; however, not all jurisdictions have detected declining prevalence in response to management (Conner et al. 2007).

CWD and human health

To date, several lines of evidence suggest that humans are at low risk of contracting CWD. There have been no documented cases of CWD causing disease in humans, despite epidemiological investigations of known or suspected exposures (Belay et al. 2004, MaWhinney et al. 2006). Several studies have demonstrated that human prion proteins, either in cell-free culture (Raymond et al. 2000) or as expressed in transgenic mice (Kong et al. 2005, Tamgüney et al. 2006, Sandberg et al. 2010, Wilson et al. 2012), do not readily convert to the diseased form when challenged with CWD prions. Furthermore, studies published to date suggest that exposure experiments in cynomolgus macaques, a primate considered a close experimental model for humans, do not result in disease expression (Race et al. 2009, Race et al. 2014); however, a recent non-peer reviewed Canadian study (Czub et al. 2017) suggests that macaques can be infected by oral administration of CWD-infected meat.

Scientists and human health officials agree that it is prudent to minimize human exposure to CWD. The Centers for Disease Control (CDC) and the World Health Organization advise against

FWP CWD Mgmt Draft

consuming any animal known to be infected with CWD. Furthermore, the CDC recommends that hunters strongly consider having their animals tested before eating the meat when hunting in areas where CWD is known to be present.

Some simple precautions should be taken when field dressing deer, particularly in CWD surveillance/endemic areas:

- Wear rubber gloves and eye protection when field dressing game animals.
- Minimize the handling of brain and spinal tissues.
- Wash hands and instruments thoroughly after field dressing is completed.
- Avoid consuming brain, spinal cord, eyes, spleen, tonsils and lymph nodes of harvested animals. (Normal field dressing coupled with boning out of a carcass will essentially remove these parts.)

History of CWD surveillance and planning in Montana

FWP conducted active surveillance for CWD from 1998 through 2011, and more limited, opportunistic surveillance from 2012-2016 across the state. From 1998 to 2016, over 17,000 wild deer, elk, and moose were sampled for CWD with no positive detections (for a detailed history of CWD surveillance in Montana, see Anderson et al. 2012). The intensity and distribution of surveillance varied over time with the most intensive efforts from 2002 to 2011 coinciding with the availability of federal funding. Following a detection of CWD in a captive game farm outside of Phillipsburg in 1999, FWP began focusing surveillance efforts on "high-risk" areas of known proximity to CWD detections. In 2013, FWP released a report titled "Selected Results from Surveys of Resident Big Game Hunters and Private Landowners Regarding the Topic of Chronic Wasting Disease" (Lewis et al. 2013) in which the agency reported on hunter and landowner awareness of CWD and their preferences regarding CWD management. In 2014, FWP modified its CWD Management Plan for Free Ranging Wildlife in Montana (Montana Fish, Wildlife and Parks 2013, 2014) and called for a renewed surveillance effort in high-risk areas using a weighted surveillance strategy (Walsh 2012) alternating efforts among areas annually. In collaboration with FWP, Russell et al. (2015) combined information on distance to the nearest known CWD cases along Montana's borders and relative mule deer densities to predict the areas within Montana at highest risk of becoming infected through the natural spread of the disease. Their work identified several areas on the northern and southern borders of the state that have since been used to define the agency's priority surveillance areas (see Chapter 2). In addition, several research projects have examined mule deer movements near our borders with Wyoming (Carnes 2009), Alberta, and Saskatchewan (Montana Fish, Wildlife and Parks 2017) to better inform our risk assessments and potential management responses. In 2016, FWP began regularly convening its internal CWD Action Team and in 2017, assembled the CWD Citizen Advisory Panel for surveillance and management planning purposes.

Alternative Livestock Operations (Game Farms) in Montana

Ballot Initiative 143, passed in 2000, prohibited the creation of any new game farms in Montana. In 2017, there were 29 licensed facilities, and 21 of them had animals totaling about 775 captive cervids. Existing game farms are regulated by the Department of Livestock and

FWP CWD Mgmt Draft

FWP, which inspects the properties to ensure appropriate fencing is maintained. Regulations include a mandatory CWD testing program for all licensed farms and provisions for depopulation and decontamination should CWD be detected. If CWD were detected within a Montana game farm, FWP would define the surrounding hunting districts as high-priority surveillance areas.

PREVENTION

The following statutes and policies help prevent the introduction and spread of CWD into Montana:

Baiting and Feeding

Feeding of big game animals facilitates the transmission of disease by concentrating and aggregating animals. Baiting and feeding of big game animals is illegal in Montana under MCA § 87-6-216(1)(c), which states, "a person may not provide supplemental food attractants to game animals by purposely or knowingly providing supplemental feed attractants in a manner that results in an artificial concentration of game animals that may potentially contribute to the transmission of a disease or that constitutes a threat to public safety."

Scents and Lures – MCA § 87-6-2xx (effective Jan 1, 2018, number not yet assigned) prohibits the use or sale of deer or elk urine to mask human odor if the urine originated in a state or province with documented occurrences of CWD.

Carcass Transport

CWD prions in animal excreta or carcasses have been shown to remain infectious for at least two years in the environment (Miller et al. 2004). Due to the concern over indirect, environmental transmission, 41 states (including Montana) and seven Canadian provinces have restricted the import of hunter-harvested cervid parts (www.*cwd-info.org*). Montana law (MCA § 87-6-4xx, effective Jan 1, 2018, number not yet assigned) prohibits the import of heads and spinal columns of cervids harvested in states or provinces that have CWD in wild or captive populations. A list of those states and provinces is posted on FWP's website and in the big game regulations and kept current by agency personnel. Importing processed meat, quarters, hides, antlers and/or clean skull caps, ivories, de-boned meat, and finished mounts is allowed.

Rehabilitation/Translocation

Currently, live animal tests for CWD are invasive, expensive, and less sensitive than post-mortem tests. Movement of live cervids within Montana or importing live cervids from outside Montana risks introducing or spreading CWD. As of 2005, FWP no longer rehabilitates orphaned elk calves and deer fawns (Montana Fish, Wildlife, and Parks 2008). This policy eliminates the potential spread of CWD that could occur by mixing CWD infected and non-infected orphaned animals at the rehabilitation facility and later releasing those animals in the wild.

FWP CWD Mgmt. Draft

FWP has not moved wild cervids within the state since 1997 when elk from the Moiese Bison Range were transplanted to Region One. FWP's current policy restricts the import or movement within the state of wild cervids. Intra- and interstate movement of game farm animals is regulated by the Department of Livestock. Intrastate movement currently requires negative tuberculosis and brucellosis tests prior to movement. Import of captive cervids from other states requires not only negative tuberculosis and brucellosis tests for individual animals, but also assurance that the herd of origin has been under an active CWD surveillance plan for 5 years with no incidence of CWD.

Carcass Disposal

Environmental contamination through dispersal of heads and spinal columns from butcher waste has the potential to introduce or spread CWD in wild populations. The U.S. Environmental Protection Agency (EPA), the State of Wisconsin, and the U.S. Department of Agriculture have identified appropriate carcass disposal methods to include burying waste in municipal solid waste landfills (MSWLFs), incineration, alkaline hydrolysis tissue digestion, or on-site burial. The EPA currently recommends using MSWLFs for the large-scale disposal of potentially CWD-contaminated carcasses and wastes.

As of October 2017, CWD has not been found in Montana's free-ranging cervids. Carcass parts from animals harvested in the state are therefore considered "low risk" for containing the prion that causes CWD and may continue to be disposed of in MSWLFs. Should CWD be found in Montana, carcass waste of animals harvested from management areas where CWD has been detected could still be disposed in an approved (40 CFR Part 258) MSWLFs. The Montana Department of Environmental Quality, Solid Waste Division, regulates and certifies MSWLFs and has provided a list of Class II sanitary landfills qualified to dispose of potentially CWD-contaminated materials. Carcasses and carcass wastes with CWD may also be incinerated when possible. FWP will continue to educate the public, meat processors, taxidermists, and MSWLF operators on the proper disposal of carcasses and carcass parts of cervids.

People Involved in Developing Montana's CWD Management Plan

FWP CWD Action Team Members

John Vore, Game Management Bureau Chief, Chair
Dr. Emily Almberg, Wildlife Disease Ecologist
Dr. Jennifer Ramsey, Wildlife Veterinarian
Dr. Jessy Coltrane, Wildlife Biologist, Kalispell
Ryan DeVore, Wildlife Biologist, Broadus
Julie Golla, Wildlife Biologist, Anaconda
Scott Hemmer, Wildlife Biologist, Havre
Matthew Ladd, Warden, Billings
Michael Lee, Commercial Wildlife Permit Manager, Enforcement Division
Greg Lemon, Conservation Education
Karen Loveless, Wildlife Biologist, Livingston

FWP CWD Mgmt Draft

Adam Pankratz, Warden Captain, Bozeman
Justin Paugh, Wildlife Biologist, Big Timber
Ryan Rauscher, Wildlife Biologist, Conrad
Zach Zipfel, Legal Counsel, Helena

Montana CWD Citizen Advisory Panel Members

Bret Barney, Wyola, Region 5, Sunlight Ranch Wildlife Manager

Ed Bukoskey, Rosebud, Region 7, served on Brucellosis, Private Land Public Wildlife & Elk Archery Working Groups

Joe Cohenour, East Helena, Region 3, Active sportsman, helped draft and pass 2 CWD bills into law, RMEF Volunteer, ex-PLPW, ex CAC member, Brucellosis Working Group member.

Dr. Richard Douglass, Butte, Region 3, Emeritus professor of biology at MT Tech, serves on Brucellosis Working Group

Tim Feldner, Helena, Region 3, Retired FWP Commercial Wildlife Permit Manager, co-author 2005 CWD Plan

Dr. Tom Geary, Miles City, Region 7, Research Animal Scientist USDA Agriculture Research Services

Henry Gordon, Chinook, Region 6, Former Citizen Advisory Council member, Landowner & Rancher

James Haggerty, Belt, Region 4, Rancher, RMEF & BCHA member

Chad Klinkenborg, Bozeman, Region 3, Mule Deer Foundation Montana Regional Director

Dr. Charles Noland, Worden, Region 5, Former Citizen Advisory Council member, Landowner, Livestock Veterinarian

Dr. Brent Race, Corvallis, Region 2, Research veterinarian at Rocky Mountain Lab working on prions

Dr. Ben Rossetto, Kalispell, Region 1, Physician, Hunter, non-consumptive user, former Chief of Staff Kalispell Regional Medical Center

FWP CWD Mgmt Draft

CHAPTER 2.
MONTANA'S CWD SURVEILLANCE PLAN

Montana Fish, Wildlife, and Parks' CWD surveillance plan will use finite resources to maximize our ability to detect CWD. This entails (1) continuing to test any symptomatic cervid (deer, elk, or moose) statewide, (2) focusing systematic surveillance primarily on mule deer, the most susceptible species within Montana, and (3) employing a weighted surveillance strategy aimed at detecting 1% CWD prevalence with 95% confidence (Walsh 2012) that rotates among all currently identified, high-priority CWD surveillance areas. High priority surveillance areas (Fig. 1) have been defined and updated by combining information on distance to the nearest known CWD cases along Montana's borders and relative mule deer densities (Russell et. al 2015). These priority surveillance areas are those most likely to be infected through natural spread of the disease. Although we intend to prioritize the sampling of mule deer, we will also sample elk, white-tailed deer, and moose on an opportunistic basis. Samples will be collected from symptomatic animals, animals necropsied from research projects, hunter harvested animals, and road-killed animals. This effort will require (1) hiring five temporary technicians (one for 32 weeks, and four for 16 weeks, roughly starting Sept 1) to assist with sample collection and processing, and (2) increased educational outreach during hunting seasons. In addition, there will be an increase in overall testing costs to accommodate the extra volume of samples. FWP Wildlife Health Program staff and the technicians (supervised by the Disease Ecologist) will be primarily responsible for implementing the surveillance program with additional support from regional staff.

<u>Priority surveillance areas, minimum surveillance units, and rotation schedule</u>
Russell et al. (2015) combined information on distance to the nearest known CWD cases along Montana's borders and relative mule deer densities to predict the areas within Montana at highest risk of becoming infected through the natural spread of the disease. FWP has used this information to identify high priority surveillance areas (Fig. 1), which also include the area surrounding Philipsburg, where Montana had its only recorded case of CWD at a captive game farm in 1999. Since CWD could be spread through the inadvertent or illegal movement of a CWD positive cervid carcass into the state, we will formally survey additional areas of the state outside of the high priority surveillance zones.

Priority surveillance areas will be divided into spatially defined sampling units in which surveillance will be conducted. These "minimum surveillance units" are defined as aggregations or portions of deer hunting districts that encompass populations of ≤15,000 deer (mean = 8,450, median = 8,500) (Table 1). The minimum surveillance units are meant to capture discrete population units of deer that are well-mixed. Surveillance will occur in up to four of these minimum surveillance units per year, grouped by geographic proximity to facilitate logistics (Table 1). We will rotate to a new group of minimum surveillance units each year within a three-year rotation. Outside of these high-priority surveillance areas, we will (1) continue to collect and test all symptomatic deer, elk, or moose, regardless of the location within the state,

FWP CWD Mgmt Draft

and (2) visit at least two new non-priority areas for surveillance within the three-year rotation described above (Table 1). The location and boundaries of these non-priority areas would be determined by input from regional managers and biologists and would be restricted to a population size of ≤15,000 deer.

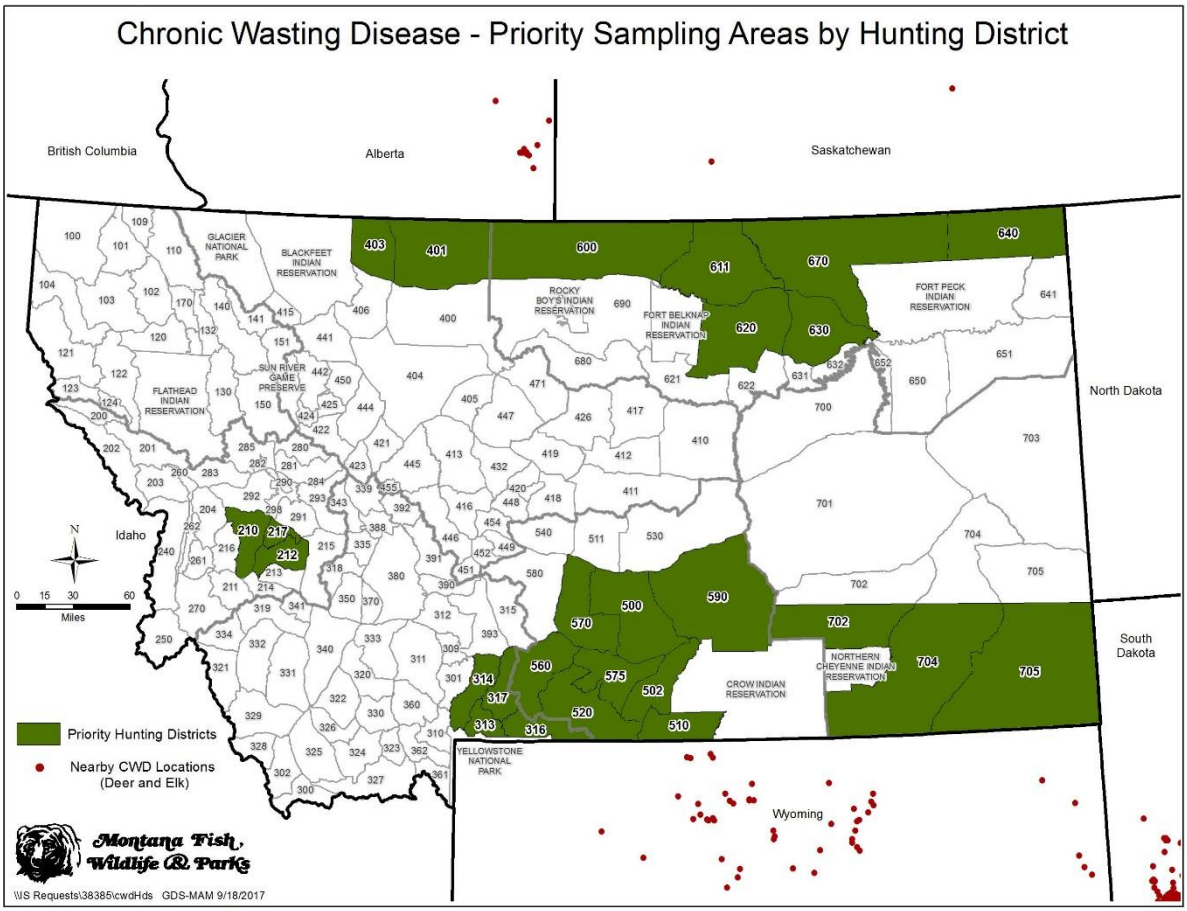


Figure 1. High priority chronic wasting disease (CWD) surveillance areas for mule deer in Montana. Priority surveillance areas were identified based on proximity to known CWD cases in neighboring states/provinces (red dots) and high relative mule deer densities in Montana based on the work of Russell et al. (2015). The surveillance area encompassing Hunting Districts 210, 212, and 217 surrounds the approximate location of the captive elk facility that tested positive for CWD in 1999. Mule deer hunt districts are displayed.

FWP

<u>Weighted surveillance, sample size and sampling distribution</u>

Within each minimum surveillance unit, we will use a weighted surveillance strategy (Walsh 2012). Weighted surveillance incorporates the relative risk of different demographic groups (age, sex, or cause of death categories) to economize sampling efforts. For example, previous studies on mule deer in Colorado have shown that within CWD endemic areas, symptomatic individuals are much more likely to be CWD positive than apparently healthy, hunter-harvested

animals (Walsh 2012). Similarly, at least with mule deer, animals that have died due to vehicle collisions, predation or other unexplained mortalities are more likely to be infected with CWD. Adults of either sex are more likely to be infected than young animals, as they have had more time to become infected, and males are more likely to be infected than females. These differing probabilities of infection have been used to create a weighted point system, where animals that are more likely to be infected with CWD are given more points towards meeting a sample size goal (Table 2) (Walsh 2012). These estimated points are unique to each cervid species and cannot be combined across species.

Table 1. Table of proposed minimum CWD surveillance units (aggregations or portions of mule deer hunt districts; Figure 1), their estimated population size (2015 estimates), and suggested groupings of units to be visited within the same year.

Minimum CWD surveillance units for mule deer populations (aggregations or portions of hunt districts)	Estimated mule deer population size	Grouping of surveillance units to be visited within a year
313, 314, 316, 317	5000	A
520, 560, 575	8500	A
510, 502	4500	A
570, 500, 590	11500	A
210, 212, 217	2000	B
401,403, 600, 611	8500	B
Rotating surveillance area (e.g. Region 1)	-	B
670, 640, 620, 630	12500	B
702*	5000	C
704*	12000	C
705*	15000	C
Rotating surveillance area (e.g. Region 1)	-	C

*Only the southern half of these hunting districts will be targeted for surveillance.

Using weighted surveillance, our goal is to detect CWD at a threshold of 1% prevalence with 95% confidence. The required sample size, using the standard equation for calculating the number of samples needed to demonstrate freedom from disease (Dohoo et al. 2009), is 300. Thus, with 300 weighted surveillance sample points we expect to be able to detect at least one positive with 95% confidence if CWD were present at 1% prevalence within a minimum surveillance unit (Table 3, also see *Sample size calculations to detect disease presence with 95% confidence* at the end of this chapter). Sample size requirements are relatively invariant to population size if trying to detect the disease at a specified prevalence (Walsh 2012). In addition, sample size estimates are specific to a single species within a minimum surveillance

FWP CWD Mgmt Draft

unit. Therefore, our surveillance efforts will focus on mule deer since they are the species with highest observed prevalence and are believed to be most susceptible to CWD within our state (Miller et al., 2000). In surveillance units where we may not be able to obtain enough mule deer samples, we will opportunistically sample elk, white-tailed deer, and moose; however, these samples will not count towards meeting sample size objectives in mule deer for that minimum surveillance unit. In white-tailed deer dominated ecosystems, such as northwest Montana, surveillance will target white-tailed deer; whereas mule deer, elk and moose will be sampled opportunistically.

Table 2. The relative weights or "points" associated with each demographic group of deer and elk that count towards meeting a sample size goal using a weighted surveillance strategy based on data from mule deer and elk in CWD-positive areas in Colorado (Walsh & Otis, 2012) and white-tailed deer in Wisconsin's CWD management zone (Jennelle et al., *in review*).

	Weight/Points		
Demographic Group	**Mule Deer**	**White-tailed Deer**	**Elk**
Symptomatic female	13.6	9.09	18.75
Symptomatic male	11.5	9.09	8.57
Road-killed males/females	1.9	0.22	0.41
Other mortalities (predation, other unexplained in adults and yearlings)	1.9	7.32	0.41
Harvest-adult males	1	3.23	1.16
Harvest-adult females	0.56	1.30	1.00
Harvest-yearling females	0.33	0.85	0.23
Harvest-yearling males	0.19	1	NA
Harvest-fawns/calves	0.001	0.001	NA

As an example, if we tested 10 symptomatic female mule deer (worth 13.6 points each) and 164 hunter-harvested adult male mule deer (worth 1 point each) broadly sampled from across our minimum surveillance unit, we would meet our 300-point goal after having only sampled 174 animals (e.g. 10*13.6 + 164*1=300 points). Understanding these relative weights allows us to maximize our limited resources. This information also reinforces the lack of value in collecting fawns or harvested yearling males because they are unlikely to be positive for CWD.

Within each minimum surveillance unit, every effort must be made to broadly distribute the sampling to maximize our ability to detect an infection (Walsh 2012). CWD infections are highly localized when they do occur (Conner and Miller 2004, Miller and Conner 2005, Farnsworth et al. 2006, Joly et al. 2006, Osnas et al. 2009, Heisey et al. 2010), and we are less likely to detect an infection if sampling is highly clustered or biased to one portion of the minimum surveillance unit. While road-kills and symptomatic animals are most valuable, they are also most likely to be collected within a small portion of the surveillance unit (e.g. roadways, human-populated

FWP CWD Mgmt. Draft

areas). Therefore, such samples must be augmented with a broader distribution of hunter-harvested samples.

If we are unable to meet sample size requirements within a surveillance year, we may continue to collect a limited number of samples in subsequent years to achieve our 300-sample point goal within a two to three-year period. CWD is a relatively slow-moving disease, and since prevalence is unlikely to substantially change over a two to three-year period, aggregating samples over this time frame is reasonable. Sampling beyond the primary surveillance year will require biologists and wardens to continue to sample symptomatic, road-killed, and hunter-harvested animals.

Sample collection, storage, testing and reporting schedule

FWP will use a variety of tools to obtain samples including working with Montana Department of Transportation, Highway Patrol, hunters at check stations, processors and taxidermists, outfitters, landowners and by sending letters to license holders. For each cervid sampled as part of the CWD surveillance program, field and laboratory staff will collect retropharyngeal lymph nodes from deer and elk (Hibler et al. 2003) and an obex sample from moose (obex may also be sampled from deer and elk the lymph nodes are not available), an incisor tooth for aging, and a small genetic sample (muscle tissue), when possible. In addition, field staff will work with hunters or others to gather precise location information on where the animal was harvested/found, species, age, and sex. Lymph nodes and obex (if collected) from deer and elk will be frozen for subsequent enzyme-linked immunosorbent assay (ELISA) testing, whereas lymph nodes and obex from moose will be fixed in 10% buffered formalin for immunohistochemistry (IHC) testing. Samples will be submitted to a National Animal Health Laboratory Network-accredited diagnostic laboratory (currently Colorado State Veterinary Diagnostic Laboratory) as soon as possible, with an expected return time for results of 1-2 weeks. Results from hunter-harvested animals will be posted on FWP's website within 3 weeks of receipt. If a harvested animal tests positive for CWD, FWP will notify the associated hunter. An annual surveillance report will be published by March 1 following the end of the previous hunting season. Press releases will be issued as soon as all test results have been received or when CWD is found.

Hunters that have harvested animals outside of a targeted surveillance unit who wish to have their animal tested for CWD will be asked to pay for the testing costs. In most cases, hunters will have to extract samples from their own animals. FWP provides information on sample collection and submission on their website (fwp.mt.gov/cwd). FWP will also request that hunters sign a release to allow the diagnostic lab to share results with FWP.

Surveillance after detecting CWD

Upon our first detection of CWD, FWP will mount a separate, intensive monitoring effort within an Initial Response Area to determine prevalence and distribution of the disease (see Chapter 3 - *Montana's Response to a Detection of CWD*). The affected area may also be monitored more frequently during future surveillance rotations to track changes in distribution and prevalence over time and in response to management actions. However, statewide surveillance outside of

FWP CWD Mgmt Draft

the Initial Response Area or CWD Management Area will be expected to continue as described in this plan. CWD detections outside of Montana, but within 10 miles of the border, will be evaluated on a case by case basis as to whether to increase surveillance or initiate a Special CWD Hunt.

Estimated Budget

Supplies	$10,500
Travel	$24,360
Shipping	$3,675
Testing Costs	$40,624
Print Costs (flyers, brochures)	$5,775
Technicians	$115,728
Total	**$200,662**

Personnel

Disease Ecologist, currently Dr. Emily Almberg, 994-6358, ealmberg@mt.gov
Wildlife Veterinarian, currently Dr. Jennifer Ramsey, 994-5671, jramsey@mt.gov
Veterinary Technician, currently Keri Carson, 994-635, kcarson@mt.gov
Research & Technical Bureau Chief, currently Justin Gude, 444-3637, jgude@mt.gov

Sample size calculations to detect disease presence with 95% confidence

The basic equation for calculating the number of weighted-sample "points" needed (n) to establish freedom from disease at a specified prevalence level (P; or proportion of the population testing positive) and with a desired level of statistical confidence (α), assuming the number of positive cases follow a Poisson distribution is (Dohoo et al. 2009):

$$n = \frac{-\ln(1-\alpha)}{P}$$

There are variations on this equation that account for population size or for imperfect test sensitivity (ability of a test to correctly identify those with the disease) and specificity (ability of a test to correctly identify those without the disease). However, since the number of weighted sample points needed are relatively invariant over the range of animal population sizes commonly encountered with ungulates, and there are errors associated with field estimates of ungulate population sizes, we have chosen to use the above, conservative equation. Similarly, test sensitivity and specificity are both high for the CWD ELISA test, and therefore we have chosen to use the simple calculation.

For a weighted surveillance strategy, the above calculation is used to determine the number of "points" needed (as opposed to the number of animals) to establish freedom from disease at a

FWP CWD Mgmt Draft

specified prevalence level and with a desired level of confidence (Walsh 2012). Weighted surveillance allows one to incorporate previous estimates of the relative risk of various demographic groups (age, sex, or cause of death categories) to economize sampling efforts. Animals that are more likely to be infected are given more points towards meeting a sample size goal.

Table 3. Weighted sample points needed to detect a specified prevalence (*P*; proportion of the population testing positive) with 95% confidence.

Prevalence (*P*)	Points Needed
0.1%	2996
1%	300
5%	60
10%	30

FWP CWD Mgnt Draft

CHAPTER 3.
MONTANA'S RESPONSE TO A DETECTION OF CWD

The following are the actions Montana Fish, Wildlife and Parks (FWP) may take upon any new detection of CWD in the state. These efforts are designed to minimize spread among herds and maintain low prevalence in infected herds. This response plan is broken into two phases, each with several steps. Phase I is the initial response to CWD detection. Phase II is the long-term management of the area once prevalence and distribution of the disease is better known. While most attention is currently on mule deer, since they appear to be the most susceptible cervid (Miller et al., 2000), similar actions would be considered for a detection in white-tailed deer, elk or moose as warranted.

Objectives for CWD management:

1. Minimize effects of CWD on cervid populations
2. Minimize health risks of CWD for humans
3. Maximize recreational opportunities
4. Maintain public trust and support
5. Increase understanding of CWD impacts on cervid populations and human health
6. Use Adaptive Management to evaluate management effectiveness
7. Minimize cost

Once CWD is detected among wild cervids in Montana, FWP's goal will be to reduce prevalence to and/or maintain it at 5% or lower within the affected population to minimize population effects and disease spread. The geographical size of the area to be managed will depend on the results of sampling during initial response described below, but would most likely be at least at the hunting district or county scale. This goal takes into consideration that once discovered, CWD prevalence in the local cervid population may already exceed 10%. If this is the case, reducing prevalence to ≤5% may prove difficult or impossible.

Phase I: Initial Response to a New Detection

Response to a new detection of CWD will follow an Incident Command Structure. The FWP Regional Supervisor will be the Incident Commander heading up response efforts if he/she has had incident command training, otherwise it will be an appropriate FWP employee with training. He/she will work closely with the Regional Wildlife Manager, the Area Wildlife Biologist, the Regional Information Officer, the Wildlife Division Administrator, the Wildlife Health Lab, and the Game Management Bureau Chief.

Step 1 – FWP Director, Regional Supervisor/Incident Commander and local F&W Commissioner determine the need for and authorize a Special CWD Hunt, Initial Response Area (IRA) and Transport Restriction Zone (TRZ).

FWP CWD Mgmt Draft

Defining an Initial Response Area (IRA) - Immediately following a new detection of CWD, FWP will define an approximately 10-mile radius (~ 314 square miles) around the site of the detection which will be referred to as the Initial Response Area (IRA). The IRA will be reasonably described using boundaries such as county roads, creeks, ridge tops, etc. to facilitate subsequent management actions. FWP will put up signs at major access points identifying the area as an IRA and that special hunting and other regulations apply. The Area Biologist and Regional Wildlife Manager will estimate the herd size, distribution, age and sex ratios, and density and will identify important movement corridors and connectivity with neighboring populations. Subsequent survey flight data may be used to modify the original IRA boundary. If other positives are detected during the initial response that are more than five miles from the index case, FWP may expand the initial IRA based on regional FWP staff input. CWD detections outside of Montana, but within 10 miles of the border, will be evaluated on a case by case basis as to whether to increase surveillance or initiate a Special CWD Hunt. We will work with neighboring states/provinces on cross-boundary management.

Defining a Transport Restriction Zone (TRZ) - With definition of the IRA, FWP will also define a CWD Transport Restriction Zone (TRZ). This zone will be one or more contiguous counties, or portions of counties, that contains the IRA. Transportation of cervid carcasses or parts, as defined below, from the IRA will not be allowed outside of this zone. We have defined a TRZ that is larger than the IRA to allow access to meat processors and taxidermists for hunters participating in a Special CWD Hunt (See below). Once a TRZ is established, it will remain in place indefinitely, even after a Special CWD Hunt ends.

Step 2 – Begin public information campaign.

Immediately following verification of a new detection of CWD, FWP's Communication and Education division will begin an aggressive information campaign as described in the *Montana CWD Public Information Plan* (Chapter 4). The information campaign will identify the site of the detection, the actions FWP is going to take, and, most importantly, the reasons such actions are necessary. Public education of the risks of CWD to our wildlife is critical in maintaining support for our management efforts.

Step 3 – Determine CWD prevalence and distribution within the Initial Response Area (IRA)

As soon as possible after initial detection, FWP will collect samples to determine CWD prevalence and distribution within the IRA. Prevalence will be assessed primarily using samples from hunter-harvested animals, most likely through a Special CWD Hunt (see below), using a non-weighted sampling design that differs from the surveillance plan sampling used pre-detection. FWP's disease ecologist will determine the sample size necessary to describe prevalence within a 2% margin of error and 95% confidence, accounting for the estimated number of deer within the IRA. This could result in required sample sizes ranging from 150-400 animals sampled (Table 4, see also *Sample size calculations for measuring CWD prevalence* at the end of this chapter for a more detailed explanation). Samples should be collected as evenly as possible from across the IRA and in rough proportion to the available age and sex classes

FWP CWD Mgmt Draft

within the population to achieve an unbiased estimate of prevalence. There is evidence to suggest that prevalence differs between the sexes. If prevalence is significantly different between the sexes, sample design and resulting management may be adjusted to target a specific sex.

These sample size goals will likely be applied to one target species, at least initially and depending on the circumstances of the area, although all other cervid species within the IRA will be sampled opportunistically. FWP will continue to collect samples from symptomatic and road-killed animals to inform the distribution of CWD within the IRA, but for statistical sampling reasons that require an unbiased sample, these will not contribute to our estimates of prevalence.

Table 4. Sample size needed per species to determine CWD prevalence with a 2% margin of error and 95% confidence in cervid populations of different sizes based on a predicted 5% prevalence.

Size of deer or elk population in the IRA	Sample size needed to determine prevalence
250	162
500	239
750	284
1000	313
1500	350
2000	372
2500	386
3000	396

Sampling to measure prevalence and distribution will be achieved using public hunting when possible, but may also include special permits to landowners who must then donate the meat to a food bank, agency lethal removal, or other means if necessary. If the first detection occurs when a hunting season could be authorized (August 15 – February 15) a public hunting effort will be mounted. If the first detection is during spring or summer, a public hunting effort will be mounted as soon as possible with consideration given to animal seasonal movements and concentrations, but may begin as early as August 15.

FWP staff will track the harvest through mandatory checks of harvested animals. FWP's Wildlife Disease Ecologist (currently Dr. Emily Almberg) and/or Wildlife Veterinarian (currently Dr. Jennifer Ramsey) will determine when the sampling requirements, as defined above, have been satisfied. Ideally, animals will be sampled by age and sex in proportion to their estimated availability in the population. If a sex or age class is under-sampled, additional sampling may be required. When sample goals are reached, the Special CWD Hunt will end.

FWP CWD Mgmt Draft

Establishing a Special CWD Hunt in the Initial Response Area (IRA)

Special Hunts within the IRA will require regulations that will likely differ significantly from regular hunting season regulations, even if the hunt occurs during the general season. The following are some of the special regulations, rules and reporting requirements that participants must follow. Additional special regulations may be warranted by circumstances of a particular hunt. Violation of these special regulations is punishable under Commission rules and regulations.

- The IRA boundaries and special regulations for hunt participation will be publicized by FWP's Communication and Education Division through press releases, social media, the FWP website, radio, TV, and other venues. This will include a definition of the IRA and the TRZ, pertinent special hunt rules and regulations, and hunt dates.
- Licenses – Existing A and B licenses will continue to be valid in the hunting district(s), including the IRA, during the general archery and firearms seasons, but hunters using those licenses in the IRA will be subject to all the special rules and regulations of the Special CWD Hunt. Additionally, hunters may purchase CWD Special Hunt B Licenses valid only within the IRA during the Special CWD Hunt. A hunter may not possess more than seven deer B licenses per year. There may be two different types of Special Hunt B licenses offered: either-sex licenses and antlerless-only licenses based on sampling need. A limited number of licenses of each type will be offered depending on sampling need, but could be up to 1,000 licenses. Only in this or another special hunt circumstance can a hunter in Montana harvest more than one antlered buck per year. In the case of a Special CWD Hunt, he/she could harvest one antlered buck with a regular A license during the general archery and firearms seasons in any open area within the state, as well as one or more antlered buck within the IRA with a Special CWD Hunt Either-sex License during the Special CWD Hunt. Other Special CWD Hunt B Licenses will be for antlerless-only. The creation and sale of CWD Special Hunt Licenses will be coordinated with FWP licensing bureau. To avoid overcrowding of hunters, Special CWD Hunt B Licenses may be valid only for a specified time. For example, a license may only be valid for a one- to two-week period, to stagger hunters throughout the duration of the hunt.
- The Special CWD Hunt will be open to any legal weapon. This means that hunters might use rifles during what would otherwise be an archery-only season.
- All animals harvested during the Special CWD Hunt must be checked at a FWP Special CWD Hunt Check Station within two days. FWP will establish at least two check stations at access points to the IRA to collect samples and aid hunters. Check stations will be open from 10:00 AM to 1 hour after sunset as determined from sunrise/sunset tables in FWP hunting regulations. These check stations will be operated only as part of the CWD management action. The stations will be staffed by FWP personnel and possibly volunteers or staff from partner agencies. Hunters will be required to document the exact location of the kill using a GPS or USGS Topographic Map. Hunters who quarter or bone out their animal must bring the head and meat to the check station for inspection.
- Submission of a sample for CWD testing will be mandatory for all cervids harvested in the IRA during a Special CWD Hunt regardless of type of license used. Species, sex, and age of

FWP CWD Mgmt Draft

the animal will be recorded and retropharyngeal lymph nodes or obex, a tooth for aging, and a genetic sample will be collected.

- Whole carcasses of cervids harvested within the IRA cannot be transported out of the TRZ. All cervids taken within the IRA will be tagged at a FWP Special CWD Hunt Check Station with a tag reading "MTFWP CWD TEST" and a unique identification number. Tags will be in identical pairs: one for the carcass and one for the head or sample. Heads of animals will be surrendered at the check station, although special accommodations will be made for heads destined for taxidermy. The carcass tag will identify the animal as having been checked by FWP and serve as evidence of sex. The spinal column may be left in the field at the kill site with landowner permission. Carcass parts that may be removed from the TRZ include:
    - meat that is cut and wrapped or meat that has been separated from the bone.
    - quarters or other portions of meat with no part of the spinal column or head attached
    - hides with no heads attached
    - skull plates or antlers with no meat or tissue attached
    - skulls that have been boiled and cleaned to remove flesh and tissue
- To reduce risk of CWD spread, hunters are strongly encouraged to dispose of hides, bones and trimmings at approved landfills.
- DoL and DPHHS developed best practices for meat processors which FWP distributed via letters and Frequently Asked Questions (FAQ) sheets.
- Any area where an IRA is established is likely to include private land. A Special CWD Hunt does not grant hunter access to any private land. Hunters must get landowner permission to hunt on private land.
- If enough samples are not collected by February 15, FWP may consider other options including, but not limited to:
    - Resuming the hunt the following August 15.
    - Continuing the Special CWD Hunt after February 15. This will require special Fish and Wildlife Commission action.
    - Issuing special kill permits to landowners or their agent or designee who must donate any meat to a food bank.
    - Initiating agency lethal removal and sampling. Other precedents for agency lethal sampling include the removal of urban deer and the removal of bighorn sheep during a die-off or those that have comingled with domestic sheep.
- The Special CWD Hunt will terminate once pre-determined goals for sample size and sampling distribution have been met, although the TRZ will remain in effect indefinitely. Goals are to estimate prevalence within a 2% margin of error with 95% confidence with broad sampling coverage across the IRA.
- FWP's Communication and Education Division will publicize the end of the hunt through press releases, social media, the FWP website, radio, TV, and other venues.
- Hunters will be encouraged to take precautions, including using gloves and eye protection, minimizing the handling of brain and spinal tissues, washing hands and

FWP CWD Mgmt. Draft

instruments thoroughly after field dressing an animal, and avoiding the consumption of brain, spinal cord, eyes, spleen, tonsils and lymph nodes of harvested animals.

We realize that most hunters will want to know the test results prior to consuming their meat. Every effort will be made to return test results from within the IRA to hunters in a timely manner; however, because test results may not be known for a week or more, hunters will likely have to process their meat before they have a test result in hand.

Success of the hunt will in many cases be largely determined by private landowners' participation. Therefore, it is again vitally important the messages to the public and to individual landowners stress the threat of CWD, the importance of action, and the steps in this action plan.

Potential complications

As with any response of this nature, unpredicted circumstances are likely to arise. While this plan attempts to prepare for many of those, some could result in a level of situational complexity that will require widespread attention by department staff. For instance, if in our efforts to determine prevalence, the IRA expands dramatically by finding more positives, say from approximately 314 square miles (one positive = 10-mile radius IRA) to 3,000 square miles (10 positives depending on where they're found) the logistical complexity of our response will increase dramatically. This plan allows for that increased complexity by providing clear direction on requirements for estimating disease prevalence and guidelines for trying to contain the disease within the IRA. Additionally, though we understand that more complex scenarios will increase involvement with the public, stakeholders and the media, our communication plan can expand appropriately. Furthermore, FWP recognizes that with complexity comes additional requirements of staff, and cooperation from FWP employees from across the state will be vital.

Step 4 – Evaluate results of Phase I

The first sampling efforts through the Special CWD Hunt will inform us about the prevalence and distribution of CWD within the Initial Response Area. Prevalence will be reported for all cervids by sex and age class. Depending on what is learned, we may have to increase the geographic size of the IRA and continue with Initial Response Phase I efforts. If other positives are detected more than five miles from the index case, FWP will evaluate and has the option of expanding the initial IRA based on regional FWP staff input. Depending on what is known about animal habitat use and movements, it may be desirable to radio-collar an appropriate sample of animals to better determine seasonal movements and distribution. Long-term tracking of these animals may help to estimate transmission rates. If satisfied with Initial Response results, we will proceed to Phase II.

CWD in special buck/bull management hunting districts

Some hunting districts in Montana are managed for older buck mule deer where a hunter must possess a permit that is used in combination with a regular license to harvest an antlered buck. There are currently 37 hunting districts managed with one of

FWP CWD Mgmt Draft

two kinds of permits: an unlimited permit, which is guaranteed to the hunter if he/she applies for it, or a limited permit, which is awarded to successful applicants through a random lottery draw. There are similar opportunities for elk. Some of these, especially the limited permits, are highly coveted and drawing odds are very low.

Special buck management districts pose additional issues for CWD management if CWD is found there. First, it is known that older bucks are the most likely to become infected with and spread CWD. Second, instituting a Special CWD Hunt to determine prevalence and distribution, and any long-term change in management is likely to meet with opposition from some hunters and outfitters. Yet, if CWD is detected in a special buck management district it is just as important to address it as in any other district, perhaps more important because of the increased likelihood of older bucks acting as vectors to other areas. It will be important that FWP increase its efforts at public education regarding the risks involved with an unmanaged CWD-infected herd.

If CWD is found in either an unlimited or limited-permit special buck/bull management hunting district (e.g. HDs 270, 380 or 530), an IRA and TRZ would be established but a Special CWD Hunt would not take place until after the general season so that permit holders could still use their permit. Permit holders would be required to submit harvested animals for CWD sampling within the TRZ. Future management of the district would depend on the prevalence found during the Phase I Special CWD Hunt. If prevalence is >5%, FWP would propose an antlered-buck or either-sex season type for the district. If prevalence is <5%, FWP may choose to implement long-term management measures to prevent prevalence increase.

Phase II: Long-term Management Plan

Decisions regarding long-term management will depend on the prevalence and distribution of CWD determined in Phase I. If estimated prevalence is >5%, a program designed to reduce density and/or modify age or sex structure may be necessary. If prevalence is ≤5%, there may be no need for changing management if current season structure and management are sufficient. Regardless of prevalence determined in Phase I, a monitoring strategy will be developed to detect the spread of CWD and track CWD prevalence over time among susceptible cervid species in the infected area. This may entail annual or periodic surveillance, depending on available resources, surveillance needs elsewhere in the state, and objectives related to assessing management success. As in the initial response effort, prevalence will be tracked primarily using samples collected from hunter-harvested animals. Road-kills and symptomatic animals will also contribute to the monitoring of the distribution of the disease. Sample collection may entail the use of “head barrels” where hunters can deposit heads of harvested animals, increased sampling at area game check stations, or other means as determined necessary by the CWD Action Team.

A “one size fits all” approach to CWD management is not possible given the diversity of habitats where cervids exist. FWP personnel and local stakeholder or constituent groups will develop

FWP CWD Mgmt Draft

herd or population plans tailored specifically to circumstances of particular species, populations, or areas at a hunting district or larger scale. These herd plans would be delivered to the FWP Commission for final decision. Areas of the state may be identified based on their known infection status or estimated risk of infection. These identifiers may be used to determine appropriate management actions needed to meet stated objectives. The goals of the management program should be compatible with management strategies in adjoining areas. Management actions may consist of one or more of the following alternatives, or may be unique alternatives that have not been included in this list:

- Increased harvest, especially of antlered deer. This could manifest as expanded opportunity for all age/sex classes.
- Hot spot culling/targeted removal in limited areas around CWD detections.
- Transport restrictions. FWP would work with processors and taxidermists to help enforce.
- Reducing cervid aggregations within the management zone by removing or fencing highly localized attractants, hazing, dispersal hunts or by other means.

Evaluation of program efficacy

Once a CWD management plan has been developed, completed and approved for a specific herd or population, a monitoring program to be conducted as deemed necessary post-detection to assess management efficacy. Depending on existing CWD prevalence and management goals, this may entail securing additional funding for more intensive surveillance or research.

Communication and Educational Outreach

The *Public Information Plan for Chronic Wasting Disease in Montana* (Chapter 4) is intended to guide Montana Fish, Wildlife, and Parks' communication efforts prior to and after the detection of CWD in Montana. It includes key messages to various audiences, including the general public, hunters, stake holders, landowners and other state agencies; communication techniques that will be used; timing of strategies; overall communication objectives, and personnel responsible for executing each piece of the plan.

We must inform the public about the seriousness of CWD prior to discovery and bolster support for proposed agency action. We must also plan for the effective communication of Montana Fish, Wildlife, and Parks' response once CWD is detected. An efficient response will depend greatly on our efforts at communication with key audiences.

FWP CWD Mgnt Draft

Sample size calculations for measuring CWD prevalence

Upon an initial or new CWD detection, FWP will define an IRA and coordinate a special hunt to measure the prevalence and distribution of CWD. We want to ensure that we measure prevalence with a high level of precision while accounting for the estimated cervid population size within the IRA. This is a random sampling design, and is not the same as the weighted sampling used to determine CWD presence.

The sample size necessary for estimating a population proportion ($\hat{p}$) of a small finite population of size *N* with (1-α)100% confidence and error no larger than ϵ is calculated as:

$$n = \frac{m}{1 + \frac{m-1}{N}}$$

where $m = \frac{z^2_{\alpha/2}\hat{p}(1-\hat{p})}{\epsilon^2}$ is the sample size necessary for estimating the proportion ($\hat{p}$) for a large population (https://onlinecourses.science.psu.edu/stat414/node/264).

Thus, to estimate prevalence with a 2% margin of error (ϵ = 0.02) with 95% confidence ($z^2_{\alpha/2}$ = 1.96^2), assuming prevalence is 5% ($\hat{p}$ =0.05) and the target population size (*N*) is 300:

m = (1.96^2*0.05*0.95/(0.02^2)) = 456 and *n* = 456/(1 + (456-1)/300) = **181 animals needed** in our random sample design. Higher prevalence will result in slightly larger margins of error.

Estimated budget for a response to a detection of CWD

Item	Cost
Supplies	$23,073
Shipping & Testing Costs	$13,974
Housing & Travel (mileage, gas, hotel stays, per diem)	$38,611
Personnel (6 Conservation Tech 4, each hired for 26 weeks and 1 Conservation Tech 5, hired for 52 weeks)	$241,957
Advertisement (print, radio, and TV)	$20,400
Survey flights following first detection	$3,672
GPS collaring study for mule deer within and around the IRA	$74,613
Total	**$416,300**

FWP CWD Mgmt Draft

CWD RESPONSE FLOW CHART

Detection of CWD

Phase I – Action Alert Phone Tree and Public Information initiated. Determine Initial Response Area (IRA) as a 10-mile radius around the point of initial detection. Determine Transportation Restriction Zone.

Action Alert Phone Tree is initiated (See Chapter 4)

FWP Director, Regional Supervisor/Incident Commander and local F&W Commissioner determine the need for and authorize a Special CWD Hunt.

Com Ed begins public information outreach

Area Biologist and **Regional Wildlife Manager** define IRA with reasonably described boundaries such as county roads, creeks, ridge tops, etc. to facilitate subsequent management actions.

Phase I Initial Response

Initial response will harvest enough deer to estimate CWD prevalence within a 2% margin of error and with 95% confidence as determined by the FWP **Disease Ecologist** and **Wildlife Veterinarian**. Harvest will be primarily through public hunting during a Special CWD Hunt, but could include agency lethal removal, landowner kill permits, or other means. All cervids taken will be sampled. This will serve to determine the prevalence and start to determine the geographic extent of the disease.

Other Staff Involved: **Area Biologist, Regional Wildlife Manager, Regional Supervisor, Regional Information Officer, Game Management Bureau Chief, Wildlife Division Administrator, ComEd Division Administrator, Director.**

Determine Result of Initial Response (Phase I)

Harvest during Initial Response of Phase I will inform us about the extent and prevalence of the disease in the Initial Response Area. Depending on what is learned, we may have to increase the geographic size of the IRA and continue with Initial Response Phase I efforts. If satisfied with Initial Response results, we will proceed to Phase II. Staff is the same as in Initial Response Phase I.

Outline Phase II Long-term Management

Long-term management of the area will vary depending on results of Phase I. This may include returning to pre-detection management, revised population objectives and/or changes in season structure, or other options. Staff is the same as in Initial Response Phase I.

CHAPTER 4.
MONTANA CWD PUBLIC INFORMATION PLAN

Chronic Wasting Disease has yet to be discovered in wild cervid populations in Montana. However, testing and monitoring for CWD continues. Through the end of the 2016 big game season FWP had tested over 17,000 deer, elk and moose for CWD. None tested positive.

However, all states and provinces around Montana, except Idaho and British Columbia, are positive for CWD, including a Wyoming mule deer only seven miles from our border. With the disease so near us, it's quite possible CWD is already here, but undetected.

This public information plan is intended to guide FWP's communication efforts for CWD surveillance and our response to the detection of CWD in Montana. It includes key messages targeting various audiences, including the general public, hunters, stake holders and other state agencies, as well as communication techniques that will be used, timing of strategies, overall communication objectives, and personnel responsible for executing each piece of the plan.

Communication Problem

Montanans and those interested in hunting big game here have yet to really understand the impact CWD poses to the state's wild ungulate populations. Unmanaged, CWD could cause populations declines of ≥ 40 percent, as has been seen in other states (see pg. 3 *Biology, distribution, and population impacts*). A positive test will generate enormous interest from national and statewide media, from citizens concerned about public health risks, from hunters and conservation groups, landowners and agricultural producers concerned about impacts to wildlife populations and hunting opportunities, and from interest groups affected by specific management actions.

We must inform the public about the seriousness of CWD prior to discovery and get appropriate buy-in on proposed agency action. We must also plan for the effective communication of FWP response once CWD is detected. An efficient response will depend greatly on our efforts communicating with key audiences.

This public information plan will explore two specific areas of focus: pre-detection communication and post-detection response communication. The communication problem for each will be different:

- Surveillance and pre-detection message: The objective for this phase of the plan is to increase awareness about CWD and FWP's response plan, while generating support for the plan, as well as prevention and monitoring activities.
- Response to a detection message: The objective in this phase is to generate awareness and understanding of response, getting buy-in/support from specific groups needed for an effective response (hunters, landowners, businesses, local officials), communicating

FWP CWD Mgnt Draft

the logistics of the response and generating/maintaining support from stakeholders/public.

Communication Objective

This public information plan should accomplish the following:

- Increase awareness of CWD and current prevention strategies amongst targeted audiences.
- Provide clear understanding of surveillance program, goals and accomplishments.
- Increase awareness and understanding of FWP's CWD response plan.
- Increase support for CWD response plan amongst targeted audiences.
- Generate support for response activities so response goals can be more easily met.

Audience

- Governor's Office
- FWP Commission
- FWP staff
- FWP Citizen Advisory Councils
- CWD Citizen Advisory Panel
- CWD Alliance
- State agencies – Dept. of Livestock, State Epidemiologist, State Veterinarian, Dept. of Health, DNRC, Board of Outfitters, Tourism, Department of Environmental Quality
- Montana Veterinarian Medical Assoc.
- Federal agencies – U.S. Geological Survey, U.S. Fish & Wildlife Service, BLM, National Park Service, Forest Service, USDA/APHIS, CDC, EPA
- Tribal governments
- Local jurisdictions – county commissions, county health departments, conservation districts, grazing associations, county sanitarian
- Wildlife agencies in neighboring jurisdictions
- Stockgrowers, alternative livestock associations, Ag-related organizations and landowner organizations, Northern International Livestock Exposition, Montana Agriculture Exposition, etc.
- Media – local, statewide newspapers, radio, TV, websites, national magazines, western media (CO, WY, ID, ND, SD, Alberta, Saskatchewan, etc.)
- Legislators
- License agents
- Montana and non-resident hunters
- Commercial meat processors/taxidermists
- Outfitters/MOGA
- Statewide conservation groups and local sportsmen's clubs
- Hunter Ed and Bowhunter Ed instructors

FWP CWD Mgnt Draft

- Universities
- Landfills, waste facilities

Messages
All communication should consider these speaking points when appropriate and necessary:

Surveillance and Pre-Detection Speaking Points

- FWP has been monitoring wild cervid populations for nearly 20 years in hopes of discovering CWD early when it arrives in Montana.
- FWP's deer management to date has generally emphasized hunter opportunity over trophy bucks, which has led to a younger age structure in the buck segment and may have helped keep CWD at bay, because older bucks are the most likely to be infected and to infect other deer. This strategy is consistent with keeping disease prevalence low.
- Surveillance will involve collecting hunter harvested samples from four target areas on a rotating basis. Each target area will be sampled once every three years. Surveillance will continue even if we detect a positive case of CWD.
- FWP staff and leaders have worked diligently to prepare for the eventual discovery of CWD in wild Montana cervids. Our response plan reflects these efforts and is our best way to control CWD at acceptable levels in the immediate cervid population.
- There is no known cure for CWD.
- If left unmanaged:
    - CWD could have long-term dramatic impacts to cervid population numbers, and shift the population towards younger, immature, sub-prime-aged deer.
    - The prevalence of CWD will increase. High prevalence leads to population declines.
    - CWD will lead to the decrease in wildlife related recreational opportunities like hunting and viewing.
    - CWD could spread to other areas and/or other species.
    - Broader negative repercussions could include economic, hunting legacy, predator management, plant community management and hunting interest.
- FWP's initial response to a CWD detection will be to sample cervids with the goal of determining disease prevalence and distribution.
- When CWD is detected, initial management actions to determine prevalence and distribution will involve some level of herd reduction, dependent on individual circumstances.
- Determining disease prevalence and distribution is critical to assess risk and prepare for overall disease management.
- After CWD is detected, FWP's sampling effort will utilize public hunting and will likely include a Special CWD Hunt; however, if enough samples are not obtained by hunters,

FWP CWD Mgmt Draft

the agency will explore other options including: landowner kill permits and agency sampling.

- FWP will use science to guide decisions when determining specific management decisions, but other factors will also be considered. These will include: landowner cooperation, social acceptance of management decisions, access to animals in need of harvest, hunter willingness to participate, and financial impacts.
- Hunters should never eat meat from an animal that appears sick. Even in a healthy animal the brain, spinal column or lymphatic tissues should not be consumed. CWD has never been proven to pass from an infected animal to a human. However, the Centers for Disease Control and the World Health Organization advise against consuming meat from CWD-positive animals. Furthermore, the Centers for Disease Control recommends that hunters strongly consider having their animals tested before eating the meat when hunting in areas where CWD is known to be present.
- Meat from CWD positive animals should be disposed of properly in a landfill, as provided in MCA § 75-10-431 *et seq*.
- In executing our management actions, FWP will work with local law enforcement, governments, landowners and land management agencies.
- Seek alternative funding for surveillance, prevention and management.

Response to a Detection Speaking Points

- FWP is mobilizing an Incident Command Team to deal with the discovery of CWD, as per the approved response plan. This team will work closely with local communities, the public and other state and federal agencies.
- An Initial Response Area (IRA) has been established and encompasses a roughly 10-mile radius around where the infected animal was found/killed.
- Specific details to include during response to initial positive test:
    - Specific species, age, sex, geographic area, date and prior level of testing in the area where the infected animal was harvested
    - Herd population numbers and susceptible species in the area.
    - Specific management actions recommended in FWP's Management Plan, with rationale for action stressing need to determine the prevalence and distribution of disease before other long-term management plans are implemented.
    - Accompanying the above, a statement that FWP's management actions aren't meant to eradicate the disease, but rather to estimate prevalence and distribution, reduce prevalence if necessary, and halt the spread of CWD. Inaction is not a valid alternative.
- Announcement of public meeting in affected area and in all FWP administrative regions to discuss incident and department responses.
- FWP has created a web site devoted to CWD issues in general and the specific current incident.

FWP CWD Mgmt Draft

- FWP tested for the disease, with specific attention to "high-risk areas" and is not surprised at its arrival. Include maps showing distribution of samples collected since 1998.
- Nationwide distribution of CWD and an overview of management responses and outcomes in other states.
- Review of risk of transmission to humans and consumption advisories ("Hunters should never eat meat from an animal that appears sick, and even in a healthy animal, the nervous and lymphatic tissues should not be consumed."). Refer to language detailed in FWP's Chronic Wasting Disease pamphlet.
- Assurance that FWP has contacted the hunter who harvested the positive animal and has waived requirement that meat be consumed.
- Assurance that landowners within a 20-mile radius of where animal was harvested have also been contacted.
- Assurance that FWP is contacting landowners and land-management agencies in affected area, specifically asking trespass permission, where appropriate, to conduct management activities.
- Assurance that FWP has been in contact with the state Department of Livestock and the Department of Public Health and Human Services.
- In subsequent seasons, hunters in the IRA may need to submit heads of deer, elk and moose for testing. Results of tests will be expedited and made available to the participating hunters.
- Requirements for disposal of carcass wastes and/or contaminated carcasses, especially from IRA.
- Details on contacting FWP and Health and Human Services (county health departments, regional and statewide phone numbers), plus respected sources of CWD information (web sites, etc.), including Centers for Disease Control, World Health Organization, CWD Alliance, etc.
- Q&A format addressing basic questions of disease and its implications.

Communication Methods, Responsibilities and Timing

Method (Pre-Detection)	Responsible	Timing
News releases on CWD monitoring effort or other newsworthy items (advisory panel meeting, testing efforts, new developments, etc)	CommEd/Regional Info Officers	When necessary
Public meetings with key stakeholder groups at the regional and state level	CommEd/CWD Action Team/Regional Staff	When Necessary
Presentation with regional Citizen Advisory Committees	CWD Action Team and Regional Staff	Pre and post detection
FAQs on CWD to include monitoring efforts and information about response plan	Information Bureau Chief (Lemon)	ASAP

FWP CWD Mgmt Draft

Montana Outdoors article on CWD planning and monitoring efforts	Montana Outdoors Editor (Dickson)	ASAP
Social media posts about CWD – specifically tied to events (salvage permits, monitoring events).	Information Bureau Chief (Lemon)	
Public Service Announcements with key CWD messages (hunters look for symptomatic animals, salvage permits, etc.)	Information Bureau Chief (Lemon)	
Method (Post-detection)	**Responsible**	**Timing**
Initiate phone tree	Response Team	24 hours from confirm
Develop FAQs on detection and initial response	Information Bureau Chief (Lemon)	24 hours from confirm
Issue news release statewide upon detection confirmation. Attach FAQs*	Information Bureau Chief (Lemon)	24 hours from confirm
Establish CWD information page online with latest information, release and FAQs. Direct public and media to this page.	CommEd Division	24 hours from confirm
Convene news conference at HQ with FWP director, Wildlife Chief, CommEd chief, Incident Commander	Information Bureau Chief (Lemon)	48 hours from confirm
Speaking points to regional information officers	Information Bureau Chief (Lemon)	48 hours from confirm

*****All news releases will be done in conjunction with website and social media posts.

ACTION ALERT PHONE TREE

- A positive test result is reported to FWP Wildlife Disease Ecologist (Currently Dr. Emily Almberg 994-6358), the FWP Wildlife Veterinarian (currently Dr. Jennifer Ramsey 994-5671) or the Montana State Veterinarian (currently Dr. Martin Zaluski 444-2043 OR 475-2569 or the after-hours DoL emergency line 444-2976)
- The Disease Ecologist, Wildlife Veterinarian and/or Montana State Veterinarian call FWP Director's Office (444-3186), and Wildlife Division (444-2612)
- Wildlife Division or Director's Office calls FWP Communication and Education Division Administrator (currently vacant), Information Bureau Chief (currently Greg Lemon 444-3051), Regional Supervisor of affected region, local Fish & Wildlife Commissioner and CWD Action Team chairman (currently John Vore 444-3940)
- Information Bureau Chief, the Information and Education Manager in the affected region and the Incident Commander prepare news release

FWP CWD Mgmt Draft

- Information Bureau Chief contacts Department of Livestock's Assistant Veterinarian (currently Dr. Tahnee Szymanski 444-5214 or 465-4051) or their 24-hour emergency phone service (444-2976), and the Department of Public Health and Human Services 24-hour emergency public health line (444-0273), which will notify local county health officers, sanitarian, commissioners, etc.
- Enforcement Division contacts hunter, landowner, and appropriate external law enforcement personnel
- Information Bureau Chief distributes information via email to FWP All
- CommEd Administrator and Information Bureau Chief contact media
- Information Bureau Chief distributes news release and fact sheet to statewide media

EXAMPLE FAQs and EXAMPLE PRESS RELEASE

<u>Example Pre-detection FAQ</u>

Q. What is Chronic Wasting Disease and how do deer, elk and moose contract it?

A. Chronic wasting disease (CWD) is one type of a class of diseases called Transmissible Spongiform Encephalopathies, or TSEs, that infect members of the deer family, including deer, elk, moose, and caribou. TSEs are caused by infectious, mis-folded prion proteins, which cause normal prion proteins throughout a healthy animal's body to mis-fold, resulting in organ damage and eventual death. These prions are found throughout bodily tissues and secretions and are shed into the environment before and after death. When other cervids come in contact with the prions, either from infected live animals or from contaminated environments, they can be infected. The disease is slow acting, degenerative and always fatal. The name comes from the appearance of symptomatic animals, which get very skinny and sick-looking before they die.

Q. How will CWD impact deer and elk herds?

A. The short answer is we don't know yet. If CWD infects enough animals it will probably reduce the herd in the long term. Other states have seen deer populations decline when CWD infects 20 to 40 percent of a herd. In Wyoming, heavily-infected herds of mule deer declined 21 percent *per year* and whitetails 10 percent. Colorado saw a 45% decline in infected mule deer herds over 20 years. Clearly, if left unchecked CWD could result in large-scale population declines.

Because the distribution and intensity of CWD infections are variable across a broad landscape, the impacts across the landscape will also be variable. Keeping deer numbers down and dispersed, and reducing buck: doe ratios, may keep the prevalence low and manageable. FWP's focus will be on managing CWD infected areas for prevalence at 5 percent or lower and preventing spread. This may also mean keeping deer or elk numbers low.

FWP CWD Mgmt Draft

Q. Can humans be infected by CWD?

A. There is no known transmission of CWD to humans. However, the World Health Organization and the Centers for Disease Control and Prevention (CDC) recommend not consuming meat from an animal known to be infected with CWD. Furthermore, the CDC recommends that hunters strongly consider having their animals tested before eating the meat when hunting in areas where CWD is known to be present.

Some simple precautions should be taken when field dressing deer, particularly in CWD surveillance areas:

- Wear rubber gloves and eye protection when field dressing your deer.
- Minimize the handling of brain and spinal tissues.
- Wash hands and instruments thoroughly after field dressing is completed.
- Avoid consuming brain, spinal cord, eyes, spleen, tonsils and lymph nodes of harvested animals. (Normal field dressing coupled with boning out of a carcass will essentially remove these parts.)

Q. Is CWD dangerous to pets or livestock?

A. Currently, no evidence exists that domestic pets, companion animals, or livestock can be infected with CWD. Natural transmission of CWD to other North American animals outside the cervid family has not been found.

Q. How do you test for CWD?

A. The standard test is to look at an animal's retropharyngeal lymph nodes or brainstem for evidence of CWD. These samples can only be collected from dead animals and are submitted to a certified CWD-testing diagnostic laboratory. Unfortunately, there are no non-invasive CWD tests for live animals. For research purposes, rectal or tonsil biopsies from live animals will work, but these tests are less sensitive and require capture, anesthesia, and minor surgery, making them impractical for widespread surveillance.

Q. How can you tell if an animal has CWD?

A. Animals with CWD cannot be diagnosed based on clinical signs because they are unspecific and mild at the beginning of the disease. Diagnosis is therefore made by testing central nervous system and lymph node tissues. Symptoms of infected animals can include emaciation, excessive salivation, lack of muscle coordination, difficulty swallowing, excessive thirst, and excessive urination. Clinically-ill animals may have an exaggerated wide posture, may stagger and carry the head and ears lowered, and are often found consuming large amounts of water. However, these symptoms don't appear until the terminal stage of the disease. It is important to remember that infected animals may not have symptoms, but can still be shedding infectious prions.

Q. Why should Ranchers and Farmers care about CWD?

A. Hunters are a key tool FWP uses to help rancher, farmers and other landowners manage the impact of wildlife on their property and to their crops and livestock. If CWD were to increase

FWP CWD Mgmt Draft

in prevalence, FWP anticipates some localized decline in hunting interest. Additionally, in many parts of the state property values are tied to existing recreational values. Hunting and wildlife viewing are key components. If CWD was left unmanaged and prevalence were to increase uncontrolled, it may impact property values.

Recent research has shown that plants, including plants used for livestock food, can uptake CWD prions from the soil. If continued research shows that animals can catch CWD by eating infected plants, it could have huge repercussions on the agricultural industry. Concerns nationally and internationally about CWD transmission through feed may cause states and other countries to restrict the sale of such products from CWD positive areas. Currently, deer and elk protein, mostly from game farms, from CWD areas cannot be used in livestock feed.

Q. Why should Business owners care about CWD?

A. In Montana, outfitting and hunting make significant contributions to local economies. Across the state deer, elk and antelope hunting brings in about $400 million. This includes hotels, restaurants and gas stations in big and small communities. We anticipate the possibility that CWD will initially chill interest in deer hunting in the affected area. However, effective management will require participation from hunters and support from communities.

Q. Where does CWD come from?

A. The origin of CWD is unknown. It was discovered in 1967 in mule deer at a research facility in Colorado. Shortly thereafter it was also found in captive mule deer and elk in Ontario, Colorado, and Wyoming. By the 1990s it was discovered in wild white-tailed and mule deer, elk, and moose in Colorado and Wyoming and among captive animals in Saskatchewan, South Dakota, Montana, and Oklahoma. By the early 2000s, CWD was found in the wild in Saskatchewan, Alberta, Illinois, and Wisconsin.

CWD has continued to spread. As of 2017 it is in captive or free-ranging herds in 24 states, three Canadian provinces, Norway and South Korea. While it has not been found among wild deer or elk in Montana yet, it will likely arrive from infected wild animals in neighboring states or provinces.

Q. Can CWD be eradicated?

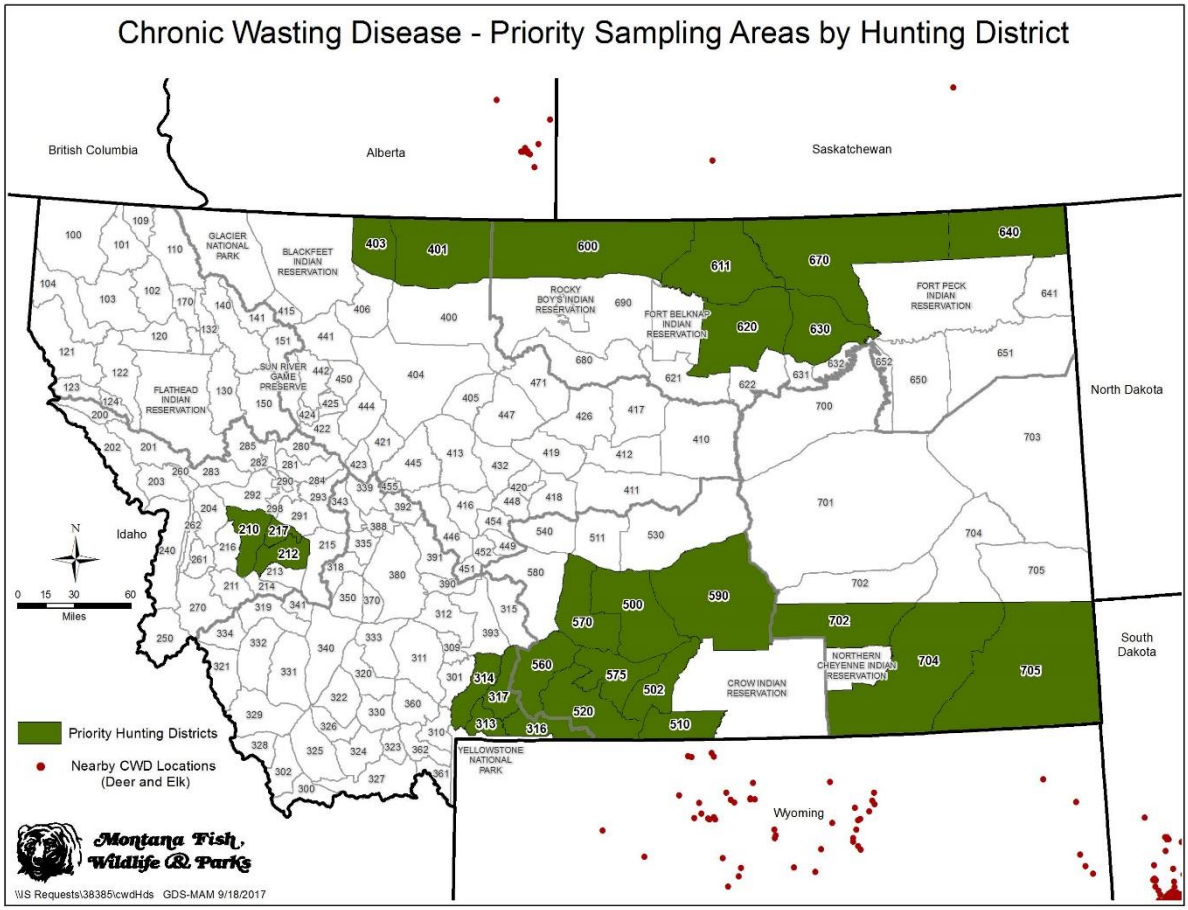
A. After decades of CWD management across the country, most agencies and researchers agree that CWD cannot be eradicated once it infects a herd. Eradication is not the goal of FWP. Other states have attempted eradication and set up unreasonable expectations with hunters and the public. Once it is found here FWP's goal is to limit the prevalence and spread of CWD.

Q. Where is Montana looking for CWD?

A. Montana FWP has identified priority surveillance areas in which we will be focusing our surveillance efforts (see map below). These areas have been identified as those at highest risk of becoming infected through the natural spread of the disease. Since CWD could be spread through the inadvertent or illegal movement of a CWD positive deer or elk carcass

FWP CWD Mgmt. Draft

into the state, we also plan to periodically survey other areas of the state that fall outside of the high priority surveillance zones.



FWP CV

<u>Example Post- detection FAQ</u>

Q. Where has CWD been found?

A. CWD was found in a mule deer buck shot in Township xx, Section x, in XX county.

Q. What is FWP going to do?

A. FWP will establish an Initial Response Area and conduct a Special CWD Hunt to find out more about the prevalence and extent of CWD. Long-term management of the hunting district will depend on what is learned about the prevalence and distribution of the disease during the Special CWD Hunt.

Q. What is an Initial Response Area?

A. The Initial Response Area (IRA) will include a roughly 10-mile radius around where the first CWD infected deer was killed. This area includes both private and public lands. It will be the focus area for a Special CWD Hunt.

Q. What is a Special CWD Hunt?

A. A Special CWD Hunt is a hunt designed to sample enough harvested animals to determine the prevalence and spatial distribution of the disease. It will occur only within the Initial Response Area (IRA) and special rules and regulations will apply. Additional Special CWD Hunt B Licenses will be available to accomplish the desired harvest level. All animals harvested during a special hunt must be brought to FWP Special CWD Hunt check stations for sampling and to be tagged with a tag reading "MTFWP CWD TEST" and a unique identification number. To prevent spread of the disease, brain and spinal column material of animals taken during a Special CWD Hunt will not be allowed out of the county or counties that contain the IRA, an area defined as the Transportation Restriction Zone. The Special CWD Hunt will end when enough deer are sampled to precisely measure the prevalence and spatial distribution of the disease, which is estimated to be between 150-400 animals.

Q. What is the Transportation Restriction Zone?

A. The Transport Restriction Zone (TRZ) is one or more counties, or portions of counties, that contain the IRA. To prevent the spread of CWD no brain or spinal column material from animals taken in the IRA are allowed outside the TRZ. We've identified the TRZ with consideration to game processors, taxidermists, and landfills so that hunters have the option for processing and disposing of animals taken in the IRA. The spinal column may be left in the field at the kill site. Carcass parts that may be taken out of the TRZ include:

- o meat that is cut and wrapped or meat that is removed from the bone;
- o quarters or other portions of meat with no part of the spinal column or head attached;
- o hides with no heads attached;
- o skull plates or antlers with no meat or tissue attached;

Q. Where can I get licenses for the Special CWD Hunt?

A. Licenses will be available at FWP Helena and Region headquarters. In addition to regular deer A and B licenses valid in the hunting district, additional either-sex and/or antlerless-only Special CWD Hunt B Licenses only valid within the IRA will be available over-the-counter first-come-first-served. Hunters are limited to up to seven B Licenses, one or more of which may be for an antlered buck, depending on the number and type of other licenses they already have. Individual hunters may take a maximum of eight deer per year in Montana, including any taken within the IRA. Only in this or another special hunt circumstance can a hunter in Montana harvest more than one buck per year. Establishment and sale of CWD Special Hunt Licenses will be coordinated with FWP's Licensing Bureau.

Q. Do I have to get my deer from a Special CWD Hunt tested?

A. YES! All animals harvested during the Special CWD Hunt must be checked at a FWP Special CWD Hunt Check Station within two days. FWP will establish at least two check stations at access points to the IRA to collect samples and aid hunters. Check stations will be open from 10:00 AM to 1 hour after sunset as determined from sunrise/sunset tables in FWP hunting regulations. These check stations will be operated only as part of the CWD

FWP CWD Mgmt Draft

management action and may be staffed by volunteers or people from partner agencies. Hunters will be required to document the exact location of the kill using a GPS or USGS Topographic Map. Sex and age of the animal will be recorded and retropharyngeal lymph nodes, a tooth for aging, and a genetic sample will be collected. Hunters who quarter or bone out their animal must bring the head and meat to the check station.

Q. How long will it take for me to find out if my deer has CWD?

A. Results from CWD testing of animals out of the IRA will be expedited, but it still may take up to three weeks. We recommend obtaining results before consuming meat from deer killed in the IRA. If your harvested deer is found to be positive, you can dispose of the meat appropriately at a landfill.

Q. Will FWP secure access to private land for hunters during the special CWD hunt?

A. No. The IRA is likely to include private land, but hunters are still required to secure access to hunt on private land.

Example News Release:

CWD found in southeast Montana

A 4-year-old mule deer buck shot 20 miles west of Broadus in October tested positive for Chronic Wasting Disease. This is the first wild animal to test positive for CWD in Montana.

CWD is a transmissible fatal brain disease that only affects deer, elk, moose and caribou. If left unmanaged, it can have long-term negative impacts on herd size and health.

Montana Fish, Wildlife and Parks is mobilizing an Incident Command Team to respond. "We've been preparing for this for almost two decades. That care and preparation will pay off with an effective and well-considered response," said FWP director Martha Williams.

FWP has established an Initial Response Area, or IRA, in Hunting District 704 that includes all land within a 10-mile radius around where the CWD-positive deer was killed.

A Special CWD Hunt will occur only within the IRA beginning December 1. The goal of the hunt is to sample about 300 harvested deer to determine prevalence and distribution of the disease. There are additional rules and regulations for the Special CWD Hunt that apply only within the IRA. Special CWD Hunt Rules, Regulations and Maps are available online at: www.fwp.mt.gov/cwd, at any FWP Region office, and at two Special CWD Hunt Check stations. Check stations are located at the junction of US Hwy 212 and State Hwy 59 three miles northwest of Broadus, and at the junction of US Hwy 212 and the Pumpkin Creek Road 22 miles west of Broadus. The Special CWD Hunt will end when enough deer are sampled to determine the prevalence and spatial distribution of the disease, but no later than February 15.

In addition to regular deer A and B licenses valid in HD 704, 300 either-sex and 700 antlerless-only Special CWD Hunt mule deer B Licenses only valid within the IRA will be

Example Only
nt Draft

available over-the-counter on a first-come-first-served basis. Hunters are limited to one either-sex, Special B License and up to six antlerless-only, Special B Licenses, depending on the number and type of other licenses they already possess. Individual hunters may take a maximum of eight deer per year in Montana, including any deer taken within the IRA.

All deer harvested within the IRA must be checked at one of the two FWP Special CWD Hunt Check Stations. Every deer harvested within the IRA must be sampled for CWD. This involves biologist taking samples of the deer's retropharyngeal lymph nodes. Test results will be available within three weeks and will be posted on FWP's website.

Brain and spinal columns of deer taken during the hunt will not be allowed to be transported outside of Powder River County, which has been declared a Transport Restriction Zone (TRZ). The spinal column may be left in the field at the kill site. Carcass parts that may be removed from Powder River County include:

- meat that is cut and wrapped or meat that is removed from the bone
- quarters or other portions of meat with no part of the spinal column or head attached
- hides with no heads attached
- skull plates or antlers with no meat or tissue attached
- skulls that have been boiled and cleaned to remove flesh and tissue

CWD is not known to infect humans. However, the World Health Organization recommends not consuming meat from CWD positive animals. Hunters are advised to have their animals tested before eating the meat when hunting in areas where CWD is known to be present. Some simple precautions should be taken when field dressing deer in the IRA:

- Wear rubber gloves and eye protection when field dressing your deer.
- Minimize the handling of brain and spinal tissues.
- Wash hands and instruments thoroughly after field dressing is completed.
- Avoid consuming brain, spinal cord, eyes, spleen, tonsils and lymph nodes of harvested animals. (Normal field dressing coupled with boning out of a carcass will essentially remove all of these parts.)

FWP has set up a special website for CWD information. This will include any public notices, hunt information and maps – www.fwp.mt.gov/cwd.

A public meeting is scheduled for Tuesday night at 7 p.m. at the Broadus High School gym. FWP Incident Command and other staff will be there to answer questions.

Example Only

LITERATURE CITED

Almberg, E.S., Cross, P.C., Johnson, C.J., Heisey, D.M. and Richards, B.J., 2011. Modeling routes of chronic wasting disease transmission: environmental prion persistence promotes deer population decline and extinction. *PloS one*, *6*(5), p.e19896.

Anderson, N., Ramsey, J., and Carson, K. 2012. *Chronic Wasting Disease Surveillance in Montana, 1998-2011: A Summary of Surveillance Efforts.* Montana Fish, Wildlife and Parks Internal Report, pp. 1-22.

Angers, R.C., Browning, S.R., Seward, T.S., Sigurdson, C.J., Miller, M.W., Hoover, E.A. and Telling, G.C., 2006. Prions in skeletal muscles of deer with chronic wasting disease. *Science*, *311*(5764), pp.1117-1117.

Angers, R.C., Seward, T.S., Napier, D., Green, M., Hoover, E., Spraker, T., O'Rourke, K., Balachandran, A. and Telling, G.C., 2009. Chronic wasting disease prions in elk antler velvet. *Other Publications in Zoonotics and Wildlife Disease*, p.46.

Belay, E.D., Maddox, R.A., Williams, E.S., Miller, M.W., Gambetti, P. and Schonberger, L.B., 2004. Chronic wasting disease and potential transmission to humans. *Emerging Infectious Diseases*, *10*(6), p.977.

Carnes, J. C., 2009. Mule Deer Population Ecology and Chronic Wasting Disease Study Southeast Montana-FWP Region 7, Final Report, July 2009. Montana Fish, Wildlife, and Parks. pp. 1-51.

Conner, M.M. and Miller, M.W., 2004. Movement patterns and spatial epidemiology of a prion disease in mule deer population units. *Ecological Applications*, *14*(6), pp.1870-1881.

Conner, M.M., Miller, M.W., Ebinger, M.R. and Burnham, K.P., 2007. A meta-BACI approach for evaluating management intervention on chronic wasting disease in mule deer. *Ecological Applications*, *17*(1), pp.140-153.

Czub, S., Schulz-Schaeffer, W., Stahl-Hennig, C., Beekes, M., Schaetzl, H., and Motzkus, D. 2017. First evidence of intracranial and peroral transmission of Chronic Wasting Disease (CWD) into Cynomolgus macaques: a work in progress. Presentation at the PRION 2017 Conference, Edenborough, Scotland. https://www.youtube.com/embed/Vtt1kAVDhDQ.

DeVivo, M.T., 2015. *Chronic wasting disease ecology and epidemiology of mule deer in Wyoming*. Ph.D., Department of Veterinary Sciences, University of Wyoming.

FWP CWD Mgmt Draft

DeVivo, M., D. Edmunds, M. Kauffman, B. Schumaker, J. Binfet, T. Kreeger, B. Richards, H. Schätzl, and Cornish, T. 2017. Endemic chronic wasting disease contributes to deer declines in Wyoming. Abstracts from the 2017 Deer & Elk Workshop, May 1-4, 2017, Sun Valley, Idaho. *In press*.

Dohoo, I., Martin, W., and Stryhn, H., 2009, Veterinary Epidemiologic Research, Second Edition: Charlottetown, Canada, VER, Inc., 865 p.

Edmunds, D., Kauffman, M., Schumaker, B., Lindzey, F., Cook, W., Kreeger, T., Grogan, R., and Cornish, T., 2016. Chronic Wasting Disease Drives Population Decline of White-Tailed Deer. *PLOS ONE*. 11 (8): e0161127 DOI: 10.1371/journal.pone.0161127

Farnsworth, M.L., Hoeting, J.A., Hobbs, N.T. and Miller, M.W., 2006. Linking chronic wasting disease to mule deer movement scales: a hierarchical Bayesian approach. *Ecological Applications*, *16*(3), pp.1026-1036.

Geremia, C., Miller, M.W., Hoeting, J.A., Antolin, M.F. and Hobbs, N.T., 2015. Bayesian modeling of prion disease dynamics in mule deer using population monitoring and capture-recapture data. *PloS one*, *10*(10), p.e0140687.

Gross, J.E. and Miller, M.W., 2001. Chronic wasting disease in mule deer: disease dynamics and control. *The Journal of Wildlife Management*, pp.205-215.

Haley, N.J., Mathiason, C.K., Carver, S., Zabel, M., Telling, G.C. and Hoover, E.A., 2011. Detection of chronic wasting disease prions in salivary, urinary, and intestinal tissues of deer: potential mechanisms of prion shedding and transmission. *Journal of Virology*, *85*(13), pp.6309-6318.

Heisey, D.M., Osnas, E.E., Cross, P.C., Joly, D.O., Langenberg, J.A. and Miller, M.W., 2010. Linking process to pattern: estimating spatiotemporal dynamics of a wildlife epidemic from cross-sectional data. *Ecological Monographs*, *80*(2), pp.221-240.

Hibler, C.P., Wilson, K.L., Spraker, T.R., Miller, M.W., Zink, R.R., DeBuse, L.L., Andersen, E., Schweitzer, D., Kennedy, J.A., Baeten, L.A. and Smeltzer, J.F. 2003. Field validation and assessment of an enzyme-linked immunosorbent assay for detecting chronic wasting disease in mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), and Rocky Mountain elk (*Cervus elaphus nelsoni*). *Journal of Veterinary Diagnostic Investigation*, *15*(4), pp.311-319.

Holsman, R.H., Petchenik, J. and Cooney, E.E., 2010. CWD after "the fire": six reasons why hunters resisted Wisconsin's eradication effort. *Human Dimensions of Wildlife*, *15*(3), pp.180-193.

FWP CWD Mgmt Draft

Jennelle, C.S., Henaux, V., Wasserberg, G., Thiagarajan, B., Rolley, R.E. and Samuel, M.D., 2014. Transmission of chronic wasting disease in Wisconsin white-tailed deer: implications for disease spread and management. *PloS one*, *9*(3), p.e91043.

Jennelle, C., Walsh, D., Samuel, M., Osnas, E., Rolley, R., Langenberg, J., Powers, J., Monello, R., Demarest, D., Gubler, R., Heisey, D. *In review*. Application of a Bayesian Weighted Surveillance Approach for Detecting Chronic Wasting Disease in White-tailed Deer.

Joly, D.O., Samuel, M.D., Langenberg, J.A., Blanchong, J.A., Batha, C.A., Rolley, R.E., Keane, D.P. and Ribic, C.A., 2006. Spatial epidemiology of chronic wasting disease in Wisconsin white-tailed deer. *Journal of Wildlife Diseases*, *42*(3), pp.578-588.

Kong, Q., Huang, S., Zou, W., Vanegas, D., Wang, M., Wu, D., Yuan, J., Zheng, M., Bai, H., Deng, H. and Chen, K., 2005. Chronic wasting disease of elk: transmissibility to humans examined by transgenic mouse models. *Journal of Neuroscience*, *25*(35), pp.7944-7949.

Lewis, M.S., Gude, J., Risley, D., and King, Z. 2013. Selected results from surveys of resident big game hunters and private landowners regarding the topic of chronic wasting disease. Montana Fish, Wildlife, and Parks, Helena, MT, pp 1-4.

Manjerovic, M.B., Green, M.L., Mateus-Pinilla, N. and Novakofski, J., 2014. The importance of localized culling in stabilizing chronic wasting disease prevalence in white-tailed deer populations. *Preventive Veterinary Medicine*, *113*(1), pp.139-145.

Mateus-Pinilla, N., Weng, H.Y., Ruiz, M.O., Shelton, P. and Novakofski, J., 2013. Evaluation of a wild white-tailed deer population management program for controlling chronic wasting disease in Illinois, 2003–2008. *Preventive Veterinary Medicine*, *110*(3), pp.541-548.

Mathiason, C.K., Powers, J.G., Dahmes, S.J., Osborn, D.A., Miller, K.V., Warren, R.J., Mason, G.L., Hays, S.A., Hayes-Klug, J., Seelig, D.M. and Wild, M.A., 2006. Infectious prions in the saliva and blood of deer with chronic wasting disease. *Science*, *314*(5796), pp.133-136.

MaWhinney, S., Pape, W.J., Forster, J.E., Anderson, C.A., Bosque, P. and Miller, M.W., 2006. Human prion disease and relative risk associated with chronic wasting disease. *Emerging infectious diseases*, *12*(10), p.1527.

Miller, M.W., Williams, E.S., McCarty, C.W., Spraker, T.R., Kreeger, T.J., Larsen, C.T. and Thorne, E.T., 2000. Epizootiology of chronic wasting disease in free-ranging cervids in Colorado and Wyoming. *Journal of Wildlife Diseases*, *36*(4), pp.676-690.

Miller, M.W., Williams, E.S., Hobbs, N.T. and Wolfe, L.L., 2004. Environmental Sources of Prion Transmission in Mule Deer. *Emerging Infectious Diseases*, *10*(6), p.1003.

FWP CWD Mgmt Draft

Miller, M.W. and Conner, M.M., 2005. Epidemiology of chronic wasting disease in free-ranging mule deer: spatial, temporal, and demographic influences on observed prevalence patterns. *Journal of Wildlife Diseases*, *41*(2), pp.275-290.

Miller, M.W., Swanson, H.M., Wolfe, L.L., Quartarone, F.G., Huwer, S.L., Southwick, C.H. and Lukacs, P.M., 2008. Lions and prions and deer demise. *PLoS one*, *3*(12), p.e4019.

Miller, M. W., and J. R. Fischer. 2016. The First Five (or More) Decades of Chronic Wasting Disease: Lessons for the Five Decades to Come. *Transactions of the North American Wildlife and Natural Resources Conference* 81: *in press*.

Monello, R.J., Powers, J.G., Hobbs, N.T., Spraker, T.R., Watry, M.K. and Wild, M.A., 2014. Survival and population growth of a free-ranging elk population with a long history of exposure to chronic wasting disease. *The Journal of Wildlife Management*, *78*(2), pp.214-223.

Montana Fish, Wildlife, and Parks, 2005. Chronic wasting disease management plan for free ranging wildlife in Montana. Helena, MT. pp. 1-89.

Montana Fish, Wildlife, and Parks, 2006. Decision Notice: Chronic wasting disease management plan for free ranging wildlife in Montana. Helena, MT. pp. 1-16.

Montana Fish, Wildlife, and Parks, 2008. Policy on Intake, Rehabilitation, Holding, and Disposition of Injured and Orphaned Wildlife. Helena, MT. pp. 1-4.

Montana Fish, Wildlife, and Parks, 2013. Environmental assessment for detection and management of chronic wasting disease (CWD) in Montana. Helena, MT. pp. 1-43.

Montana Fish, Wildlife, and Parks, 2014. Decision Notice: Chronic wasting disease management plan for free ranging wildlife in Montana. Helena, MT. pp. 1-4.

Montana Fish, Wildlife and Parks, 2017. Interim Report: Targeted Chronic Wasting Disease Surveillance in HDs 600 and 401. Internal Report, pp. 1-5.

O'Rourke, K.I., Zhuang, D., Lyda, A., Gomez, G., Williams, E.S., Tuo, W. and Miller, M.W., 2003. Abundant PrPCWD in tonsil from mule deer with preclinical chronic wasting disease. *Journal of veterinary diagnostic investigation*, *15*(4), pp.320-323.

Osnas, E.E., Heisey, D.M., Rolley, R.E. and Samuel, M.D., 2009. Spatial and temporal patterns of chronic wasting disease: fine-scale mapping of a wildlife epidemic in Wisconsin. *Ecological Applications*, *19*(5), pp.1311-1322.

Potapov, A., Merrill, E., Pybus, M., Coltman, D. and Lewis, M.A., 2013. Chronic wasting disease: Possible transmission mechanisms in deer. *Ecological Modelling*, *250*, pp.244-257.

FWP CWD Mgmt Draft

Potapov, A., Merrill, E., Pybus, M. and Lewis, M.A., 2016. Chronic wasting disease: Transmission mechanisms and the possibility of harvest management. *PloS One*, *11*(3), p.e0151039.

Prusiner, S.B., 1998. Prions. *Proceedings of the National Academy of Sciences*, *95*(23), pp.13363-13383.

Race, B., Meade-White, K., Race, R. and Chesebro, B., 2009. Prion infectivity in fat of deer with chronic wasting disease. *Journal of Virology*, *83*(18), pp.9608-9610.

Race, B., Meade-White, K.D., Miller, M.W., Barbian, K.D., Rubenstein, R., LaFauci, G., Cervenakova, L., Favara, C., Gardner, D., Long, D. and Parnell, M., 2009. Susceptibilities of nonhuman primates to chronic wasting disease. *Emerging Infectious Diseases*, *15*(9), p.1366.

Race, B., Meade-White, K.D., Phillips, K., Striebel, J., Race, R. and Chesebro, B., 2014. Chronic wasting disease agents in nonhuman primates. *Emerging Infectious Diseases*, *20*(5), p.833.

Raymond, G.J., Bossers, A., Raymond, L.D., O'rourke, K.I., McHolland, L.E., Bryant, P.K., Miller, M.W., Williams, E.S., Smits, M. and Caughey, B., 2000. Evidence of a molecular barrier limiting susceptibility of humans, cattle and sheep to chronic wasting disease. *The EMBO Journal*, *19*(17), pp.4425-4430.

Russell, R.E., J.A. Gude, N.J. Anderson and Ramsey, J.M.,. 2015. Identifying priority chronic wasting disease surveillance areas for mule deer in Montana. *Journal of Wildlife Management* 79(6): 989-997.

Samuel, M.D. and Storm, D.J., 2016. Chronic wasting disease in white-tailed deer: infection, mortality, and implications for heterogeneous transmission. *Ecology*, *97*(11), pp.3195-3205.

Sandberg, M.K., Al-Doujaily, H., Sigurdson, C.J., Glatzel, M., O'Malley, C., Powell, C., Asante, E.A., Linehan, J.M., Brandner, S., Wadsworth, J.D. and Collinge, J., 2010. Chronic wasting disease prions are not transmissible to transgenic mice overexpressing human prion protein. *Journal of General Virology*, *91*(10), pp.2651-2657.

Sigurdson, C.J., Williams, E.S., Miller, M.W., Spraker, T.R., O'Rourke, K.I. and Hoover, E.A., 1999. Oral transmission and early lymphoid tropism of chronic wasting disease PrPres in mule deer fawns (*Odocoileus hemionus*). *Journal of General Virology*, *80*(10), pp.2757-2764.

Storm, D.J., Samuel, M.D., Rolley, R.E., Shelton, P., Keuler, N.S., Richards, B.J. and Van Deelen, T.R., 2013. Deer density and disease prevalence influence transmission of chronic wasting disease in white-tailed deer. *Ecosphere*, *4*(1), pp.1-14.

FWP CWD Mgmt Draft

Tamgüney, G., Giles, K., Bouzamondo-Bernstein, E., Bosque, P.J., Miller, M.W., Safar, J., DeArmond, S.J. and Prusiner, S.B., 2006. Transmission of elk and deer prions to transgenic mice. *Journal of Virology*, *80*(18), pp.9104-9114.

Tamgüney, G., Miller, M.W., Wolfe, L.L., Sirochman, T.M., Glidden, D.V., Palmer, C., Lemus, A., DeArmond, S.J. and Prusiner, S.B., 2009. Asymptomatic deer excrete infectious prions in faeces. *Nature*, 461, pp. 529–532.

Walsh, D.P., ed., 2012. Enhanced surveillance strategies for detecting and monitoring chronic wasting disease in free-ranging cervids: U.S. Geological Survey Open-File Report 2012–1036, pp. 42.

Walsh, D.P. and Otis, D.L., 2012. Disease surveillance: Incorporating available information to enhance disease-detection efforts, In: Enhanced surveillance strategies for detecting and monitoring chronic wasting disease in free-ranging cervids: U.S. Geological Survey Open-File Report 2012–1036, pp. 11-23.

Wasserberg, G., Osnas, E.E., Rolley, R.E. and Samuel, M.D., 2009. Host culling as an adaptive management tool for chronic wasting disease in white-tailed deer: a modelling study. *Journal of Applied Ecology*, *46*(2), pp.457-466.

Wild, M.A., Hobbs, N.T., Graham, M.S. and Miller, M.W., 2011. The role of predation in disease control: a comparison of selective and nonselective removal on prion disease dynamics in deer. *Journal of Wildlife Diseases*, *47*(1), pp.78-93.

Williams, E.S. and Miller, M.W., 2002. Chronic wasting disease in deer and elk in North America. *Revue Scientifique et Technique (International Office of Epizootics)*, *21*(2), pp.305-316.

Williams, E.S., Miller, M.W., Kreeger, T.J., Kahn, R.H. and Thorne, E.T., 2002. Chronic wasting disease of deer and elk: a review with recommendations for management. *The Journal of Wildlife Management*, 66(3), pp.551-563.

Williams, E.S., 2005. Chronic wasting disease. *Veterinary Pathology*, *42*(5), pp.530-549.

Wilson, R., Plinston, C., Hunter, N., Casalone, C., Corona, C., Tagliavini, F., Suardi, S., Ruggerone, M., Moda, F., Graziano, S. and Sbriccoli, M., 2012. Chronic wasting disease and atypical forms of bovine spongiform encephalopathy and scrapie are not transmissible to mice expressing wild-type levels of human prion protein. *Journal of General Virology*, *93*(7), pp.1624-1629.

FWP CWD Mgmt Draft